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TRANSACTIONS

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ORTHODONTICS: INVESTIGATIONS IN ETIOLOGY.*

By HAROLD CHAPMAN, L.D.S.Eng., D.D.S.Penn.

MY first duty and pleasure is to thank you for the high honour you have conferred on me by my election to the chair. I am fully sensitive of the responsibilities attaching thereto; these I shall strive to carry out as my predecessors have done—in fact had I to choose a motto for the occasion it would be “noblesse oblige.”

For a considerable time it has seemed to me the question of etiology has been inadequately dealt with in dental literature, and that causes of abnormal occlusions have been assigned on insufficient evidence. In this paper I present to you twenty-nine cases, taken from twelve families, with as complete a history as I have been able to obtain, together with the result of some physical tests and measurements. The fact that this apparently simple task has not been undertaken previously is perhaps a sign that it is not as simple as it appears; for this reason I ask you to forgive the omissions which I realise are all too numerous. It should be borne in mind it is possible that causes do not act singly except in a few instances; and again, if a single one of the causes commonly assigned to cases of malocclusion be invoked as an etiological factor, another case of a similar type whose history did not contain that particular etiological factor, could be quickly brought forward to controvert the particular belief. In the few cases included in this paper there is not one or scarcely one of the recognised causes of irregularities which has not been operative, but can be proved, directly or indirectly, to have had no effect. It is therefore time that we reviewed our position in the etiological purview. Local causes have not been considered but are mentioned in the histories.

In a paper¹ last year I stated that: “Every one of us has opportunities of post-graduate instruction at his own door,” and the reports I present to-night indicate one way in which this may be done. My first intention was to proceed along the lines adopted by Murk Jansen in his book, “Feebleness of Growth.”^{2, 9} For his purposes Jansen selected families in which there were a large number of children, and these were taken from the poorer classes. But malocclusions are not confined to the poorer classes, and whether they are always associated with “Feebleness of Growth,” though it be of a less degree than Jansen has in mind, is a matter for still further investigation; but, as a result of the physical tests, which subject Mr. Friel dealt with in his presidential address³ last year, there is reason for inclining to such a view. Clinically I have no doubt many here would say that abnormal occlusions are not necessarily associated with feebleness of growth however slight, though on careful inquiry it would probably be elicited that

* Presidential Address to British Society for the Study of Orthodontics, 19th January, 1925.

there is, or was, evidence of feebleness of growth in addition to that provided by the occlusion.

The cases reported are taken from all classes of society including hospital patients, but the latter are from the better class of these : they include one family with one child, one family with four children and ten families with two or three children ; some of these families have one child with normal occlusion. As far as has been ascertainable all the children of any one family are believed to have lived under the same conditions, so that in those families where one child has a normal occlusion, environment as a cause of the abnormal occlusion in the brothers and/or sisters may be eliminated. Casts of the teeth of all are shown, also of the teeth of the parents in two families ; photographs of some are included ; graphs showing the results of the physical tests in some of the families and of some of the facial measurements are presented.

The facial measurements have been used but little in the paper because of the few statistics available for comparison. Keith and Campion⁴ state that : "The most frequent derangements of growth seen in modern English faces, is due to a deficiency or alteration in the lateral expansion which ought to take place in normal children. The most important suture involved is that between the maxilla and the malar or jugal bone on each side of the face." So I have made a few graphs comparing the lateral measurements of members of the same family, and in one instance with a case from another family, where it seemed these readily disclosed points of interest. The vertical and forward measurements of these three cases are also compared ; though they have been made in other cases they are not published.

The conclusion, which seems to be irresistible from the evidence, to be drawn from the data of these cases, is that the major causes of malocclusion are probably ante-natal, e.g. heredity and parental health, and that post-natal causes are of secondary importance even if they have any effect at all.

It will appear from the histories I am about to present that the start the child has in life—and when I say "start" I mean the ante-natal start, not only through the entire ante-natal period proper, but from an even earlier period, that is to say from the time of conception and even before that, at which periods the health of both parents is of great importance to the future offspring—is the factor of prime importance ; it is at these very early periods that the foundations of good or poor health and good or defective development of the child are being laid. If this start is not good there seems to be grave doubt if it can ever be overcome completely.

The families were selected for one or more of the following reasons :—

(1) Cases of normal occlusion in which the individuals were exposed to "reputed" causes of malocclusion. (Families Nos. 1, 7, 2, 9.)

(2) Cases of normal occlusion, the individuals possessing which have brother(s) and/or sister(s) with abnormal occlusions. (Families Nos. 7, 2, 4, 9.)

(3) Cases of brother(s) and/or sister(s) all with abnormal but dissimilar occlusions. (Families Nos. 5, 6, 8, 11.)

(4) Cases of brother(s) and/or sister(s) all with abnormal but similar occlusions. (Families Nos. 10 and 12.)

The five following paragraphs may assist in an appreciation of the histories, graphs, etc. :—

1. The sitting height, weight and age are used to estimate whether growth is normal or otherwise.⁵ The handgrip is used to give an index of general muscle development.^{6, 8.}

2. Muscle tests about the mouth are to show the development of these muscles in relation to the general muscle development (handgrip) and the relation, if any, between the muscle development and the occlusion, whether normal or abnormal. The facial measurements are those used by Keith and Campion.⁴ A few additional ones have been made.

3. In any given family the elder child has the lower number. The graphs of physical tests are compared with the normal for the sitting height, taken as 100 per cent; the abbreviations are Wt. for *weight*, R.Hg. for *right hand grip*, L.Hg. for *left hand grip*, R.M. for *right molars*, L.M. for *left molars*, I. for *incisors*, T. for *tongue*, L.V. for *lips vertical* and L.H. for *lips horizontal*. The figures on the graphs which follow the description of the occlusion are the sum of the total points above 100 per cent. minus the total number of points below; any points in excess of 50 per cent. have been reckoned as 50 per cent. The graphs of measurements are actual and must be considered in relation to age. The interdental widths are measured from the centre of the linguo-gingival margin to the corresponding point on the opposite side. The terms "linear" and "lateral" used to describe the type of individual are those employed by Northcroft.⁷ Where applicable the tabulated histories are usually given in the words of the parent as written in the questionnaire supplied to the latter. The histories, which follow, speak for themselves and may be read here; the last five pages, following the illustrations, summarize the histories. A word on the facial measurements of Cases 6, 7 and 896 (Figs. 87, 88 and 89) may not be out of place, and may be read after the history of family No. 8.

4. The last two vertical measurements of Cases 6 and 7 are of special interest (Figs. 87 and 88); whereas measurements I, III and IV are greater in 7 (Class II, Div. I) than in 6 (normal occlusion), that of measurement V is disproportionately greater, and that of measurement VII is the same. In other words, if these measurements in Case No. 6 be taken as the standard, then in No. 7 the distance from the tip of $\overline{1}$ to the submental point is too great and the distance from $\overline{6}$ cusp to the border of the mandible is too short; this leads one to suspect that in Case No. 7 the excessive overbite is due, in part at least, to increased mandibular height in the incisor region and decreased mandibular height in the molar region.

5. Case No. 896 is worthy of attention on account of the narrowness of the face compared with the length; in comparison with Case No. 6 (in which the arches are perfect) there is a considerable increase in all the vertical measurements, but a considerable decrease in all the lateral measurements (Figs. 87, 88 and 89). It is true that the upper arch of 896 is not quite perfect, but the crowding that does exist is not sufficient to affect the argument that if it were perfect the lateral facial measurements would still be narrower than those of No. 6. If Case 896 is compared with Case No. 7 (in which the vertical measurements are greater than in No. 6, and the lateral ones less), the same result is obtained as in the comparison with Case No. 6, thus emphasising the extreme divergence that may occur between the length and breadth

of the face before the bounds of normality appear to be exceeded. To deal at length with these measurements is beyond the scope of this paper, and the remaining graphs are left to speak for themselves ; they should be studied in conjunction with the casts of the teeth and the photographs of the individuals. The tables and illustrations will enable the reader to draw his own deductions and render further remarks, except of the briefest character, unnecessary.

The major causes of malocclusion operate before birth, and the factors are probably hereditary and ante-natal. Heredity is a difficult subject ; I have introduced it so that its possible importance may be investigated, which it is necessary to do through more than two generations. On this point Prof. Arthur Thomson, of Aberdeen, says : " I think casts of two generations would be of distinct value, but that one case of three generations would be worth a score of cases of two generations."

Ante-natal factors concern the father as well as the mother : in three of the five cases of normal occlusion they are definitely good ; no data in the other two, except in one (10 L.H.) " mother always enjoyed good health," but did not say this in reference to the birth of this child ; her previous child (5 L.H.) seems to be a victim of feebleness of growth (Class II, Div. I). The normal occlusion children have much better physique than the others judged by the results of the physical tests. In Class II, Div. I, only in two cases, both in the same family, are the ante-natal factors distinctly good (in one other they are " normal ") ; in this family there are four children (girls), all presenting a similar malocclusion, Class II, Div. I. Is it permissible to suspect heredity ? In the other two sisters it is questionable if the unfavourable ante-natal factors were sufficient to have a baneful effect. Endocrine factors have not been considered.

Of the post-natal causes, mastication is the one that appears to have some effect in good development, as of the normal cases four are good chewers and one no data. In Class I seven are medium or worse, and one no data. In Class II, Div. I, five are good, four medium. It was left to the parents to describe if the mastication was good or otherwise.

Artificial feeding, comforters, sucking habits, tonsils and adenoids, and mouth breathing are distributed throughout the normals, Class I and Class II, Div. I, cases ; therefore they are to be regarded as etiological factors of minor, if any, importance ; the percentage of mouth breathing cases would appear to be greatest in the Class II, Div. I, cases, but if that is so it should be regarded as concomitant rather than as causal.

It is not my intention to make any definite statement but to present simply, as I have done, the results of my investigations together with all the available material, whereby you may draw your own conclusions and compare them with those presented. The importance of arriving at a correct etiology for each case may not be appreciable yet, but will it not have to be considered in the near future much more than in the past, if treatment is to be rational ?

It will be noticed that in the graphs of physical tests many of the children with bad occlusions appear to be above normal. This needs explanation. The normals of the physical tests are based on sitting height (there being no relation to age), so that if a child were of poor height for his age it is obvious that the physical tests would

probably give results above normal but below normal if compared with age. The opposite should also be considered, whether the sitting height is too great for the age.

The summary of the results of the physical tests (Fig. 142) brings out the superiority of the normal occlusion cases ; the difference between the two classes of cases of malocclusion is small. It may occasion surprise that the series of Class I cases is a little behind that of the Class II, Div. I, cases ; it may be the position would be reversed if a larger number had been examined. Nevertheless the inference seems to be that malocclusion and a musculature below normal strength seems to go hand in hand ; possibly they have a common origin and act in a vicious circle ; the explanation of the weakened musculature may not always be the same. Antenatal conditions, nutrition, function and general health would on *à priori* grounds seem to be possible factors in producing a normal or abnormal musculature ; the histories as presented—full as they are, but probably not full enough—enable one to form some opinion as to the causes which may have been operative in inhibiting bone growth in any particular case, and these same histories (and additional ones) make it clear that malocclusion goes hand in hand with other evidence of “Feebleness of Growth.” The treatment to be adopted must be decided after consideration of these and all other factors, and indeed these latter may need treatment.

In families where a later child is better physically than an earlier one, a factor, not referred to earlier, may be the improved financial position of the parents at the later period, enabling them to obtain all the necessities essential to the rearing of physically sound children, e.g. their own better health, less mental and physical strain on the mother, ample food, good housing, etc. Family No. 2 is probably an example of this factor. The financial and social position and the advantages that go with it seem to have some effect. In families 2 and 7 this may be contrasted ; in the former, two of the boys, age 18 and 14, are already at work ; in the latter both boys, age 19 and 18, are at the university. Case No. 7 (Family No. 7) (born at end of sixth month) might appear to have had a very poor start, but according to the summary of physical tests is very little behind the two boys (Cases 868 and 869) of family No. 2, who have not normal occlusion ; in fact, in preparing the graphs Mr. Friel commented that Case No. 7 is a long way ahead of Cases 868 and 869, though behind Cases 6 and 870, both normal occlusion cases.

Finally I would stress the desirability, nay, the necessity, of taking elaborate histories of all cases that an effort may be made to trace the etiology of abnormal occlusions and their association and correlation with other physical defects as well as with antenatal conditions or factors which are below normal, and of discovering if it is possible for a child to overcome a bad start.

In my preamble I have complained of the assignment of causes on insufficient evidence ; I fear I may be open to the same charge—I hope in a lesser degree. This Society can go a long way to remove the charge if every member will investigate only one family of three children each, and in a year's time we should have the records of 170 families and 500 children.

My hearty thanks are due to all those parents who have so kindly helped me and enabled these histories to be compiled, as well as given permission for the photographs of their children to be shown ;

to our late President, Mr. Sheldon Friel, for furnishing the norms for the graphs of the "physical tests," and assistance in the drawing of the latter; to Miss V. H. George for working out the palatal areas, and, lastly but not least, to my assistants who have done so much in the preparation of the various stages involved in the presentation of this paper.

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DISCUSSION.

Dr. SIM WALLACE said he had been very much impressed with the paper and the extraordinary amount of work put into it and its general importance. He was always pleased to see theories which were based on insufficient evidence, as had been the case in some of his own theories, buried in their graves, as Mr. Chapman had kindly buried several theories that evening. But still there were one or two that were still unburied. Like Mr. Chapman, he had been following Jansen's work on the growth of bone and the only effect it had had on the theories that he used to hold was to throw them just a little back. The President had stated, firstly, that injurious agents affecting growing cell groups enfeebled their power of growth and, secondly, that the measure in which growth was enfeebled was proportional to the rapidity of growth, which he (the speaker) would term the law of vulnerability of fast-growing groups. That feebleness in growth he originally ascribed very largely to lack of mastication. But the President had killed that idea, in that way doing what other factors operating on his mind had done, causing him to cease to put the same importance on mastication latterly as compared with the importance he attributed to it in his earlier days. Gradually he had come to the conclusion that the injurious agents were more in the nature of ill-health. Primarily he had considered the individual had developed a bad jaw, but he thought he was justified in going further back and in thinking that the injurious agent might be the result of the mother's health. Therefore the causes of irregularities were pushed back further and further to the ante-natal effects, where there was an injurious agent acting on the most rapidly growing cells and causing consequently bad cases of irregularities. Members of the Society knew now that they were very early in coming into being. Cases of Class II, post-natal occlusion, he thought came into being with the eruption of the first temporary molar. It was very difficult to get the children in order to see what the occlusion was at that age, but if they could be obtained he thought it could be shown that most of the bad cases of post-normal occlusion were in being immediately the teeth erupted, showing that the injurious agent which acted in enfeebling the growth of the lower jaw had been

in existence before the eruption of the teeth. Another thing which he thought the President had shown very clearly, was that all irregularities were brought about primarily by an enfeeblement of growth. The jaw practically was never too large for the teeth; he did not know that he had ever seen a case where the thirty-two teeth were too small for the jaw. He had seen cases where some teeth had been absent and there had been a certain amount of spacing. Only recently he had seen a case where the wisdom teeth were not present in a girl of 26, who had very good occlusion, but there were slight spaces to be found. The causes, he thought, must be looked for in injurious agents acting on the bone. Teeth seemed to form independently of injurious agents and had their size independent of the many injurious agents that seemed to disturb the growth of bone. He wished to congratulate the Society on having Mr. Chapman as President. Recently, in speaking to an American about the Society, the American had said that the B.S.S.O. was the best Orthodontic Society, and he was bound to agree that that was so, and he thought the Society had had one of the best papers that evening, from one of the best men.

Mr. J. H. BADCOCK congratulated the President on his excellent address, one which he was sure would make orthodontic history.

Mr. NORMAN G. BENNETT also added his congratulations to the President for an excellent paper. If he had to say what he appreciated most he should say it was the glorious iconoclasm of the paper, which had made his brain reel! Perhaps, however, it did not upset previous theories to so great an extent as might be at first considered. He thought probably the President would urge that the various factors which had been put forward from time to time, post-natal factors causing errors in occlusion, were not necessarily non-existent because they did not operate in some of those cases, but that such post-natal factors perhaps acted best when the soil was favourable on account of ante-natal or hereditary factors. He had felt convinced for a long time that many post-natal factors were not as important as was generally considered. For instance, many years ago Mr. Rawlinson Whitaker, of Birmingham, read a paper before the British Dental Association, in which he brought forward very conclusive evidence to show that adenoids as such were not a cause of contracted arches, but that the contracted arches and adenoids were the result of one cause which was probably thyroid insufficiency. It was treading on very difficult ground to deal with such questions, but when further progress was made into the question of heredity it was not perhaps such a difficult matter, although the ground was very complex. The consideration of some of the questions resulted in having to represent the classification of a case as Class II, Division I, and he hoped some member of the Society would invent a term to take the place of such expressions. The so-called Class II, Division II, was, he thought, in the experience of many, very definitely hereditary. Members must have come across cases again and again in which Class II, Division II, occurred in members of the same family, while only one parent had it very markedly. He disagreed with Dr. Sim Wallace on one point, that of small teeth in large areas. He did not know that he could show Dr. Sim Wallace cases in which the thirty-two teeth were there, because some of them might have been extracted, and in other cases the patient might have been too young to have arrived at the thirty-two teeth. But he could show him cases of rather large arches and well-developed jaws in which the teeth were small and all the front teeth were spaced as far as the first premolar. He thought that must be within the experience of other people. He congratulated the President on having gone one stage backward and at the same time one stage forward in estimating the causes of abnormality. Personally he was not at all convinced that all cases of post-normal occlusion were necessarily defective growth in the true sense of the word. He thought that some cases of post-normality were normal to the individual, and he did not think those individuals showed in any other respects signs of insufficient growth. Sometimes they were well developed physically

and mentally; they might have satisfactorily wide arches and yet a post-normal occlusion.

Mr. SHELDON FRIEL said it might be imagined from the President's address that the present theories of the etiology of malocclusion had received a set-back, but he considered that there were some that had not, especially function. Dr. Sim Wallace seemed to consider that function was not as important as he used to think, but he himself was inclined to believe it was more important. Practically all the cases that the President had exhibited on the screen did not show any wear on the deciduous teeth. In his examination of early skulls and of very well developed arches the deciduous molars were worn flat. Many of the cases shown on the screen, and termed by the President Class I, he did not think were Class I. The temporary molars were in the relation that existed when the deciduous teeth had erupted. At the time of the loss of the deciduous incisors the occlusion of the deciduous molars was not the same as it was at $2\frac{1}{2}$ years of age, the lower jaw was forward, so that there was a slight mesial relation of the lower deciduous molars. Examining the young Saxon skulls of Mr. Humphries, of Birmingham, it would be noticed that where there was great wear the lower jaw had come forward. He had had another example recently of the effects of function. A healthy looking child of about 13 years came to him and he examined her mouth and found that she had two perfectly even rows of teeth, but the only teeth in contact were the upper left central and the lower left lateral, she had what was called an "open bite" from these two teeth backwards. When he tested her with the gnatho-dynamometer he found she had an average incisor pressure, but had practically no pressure with her molars. That happened to be the third similar case he had seen of "open bite" with loss of muscular power. Of the other two cases one had an open bite in the posterior region on both sides, and the other only on one side. All three exhibited the want of molar pressure. The first two cases he endeavoured to treat with appliances, but the teeth seemed to delight in moving in any direction in a horizontal plane and not in the vertical plane. That had made him very sceptical whether such cases could be treated where there was lack of muscular development. He wished to join in congratulating and thanking the President for his very able address.

Mr. NORMAN BENNETT asked Mr. Friel whether he considered that the change in the occlusion of the deciduous dentition was a real change in the static occlusion, or merely that with advancing years the child in mastication moved its jaws forward and backward so much that it caused the cusps to wear. It was agreed that jaw movements in children were much more usually posterior than in the case of adults. That would not necessarily produce a change in the static occlusion.

Mr. FRIEL thought it was a natural change, and must exist in order to have normal occlusion. There was a difference between the mesio-distal diameter of the lower second deciduous molar and the upper second deciduous molar, and if the lower jaw did not come forward an amount nearly equal to this difference there must necessarily be what was called a post-normal occlusion. The permanent molars, after the loss of deciduous teeth came forward an equal amount, on account of the difference in the mesio-distal diameter of the deciduous canines and molars and their successors, but he thought the lower jaw must come forward by itself to allow the permanent molars to occlude correctly.

The PRESIDENT said he might quote two lines which he did not read from his paper: "Of the post-natal causes mastication is the one which appears to have some effect in good development, as of the normal cases four are good chewers out of the five." He thanked the members very kindly for the manner in which they had received his address and thanked Mr. Grayson and Mr. Northcroft for their casual communications.

Mr. GEORGE NORTHCROFT, in moving a hearty vote of thanks to the President for his address, said it had been greatly appreciated by everyone present. The motion was carried unanimously.

FAMILY No. 1. ONE CHILD.
FIGS. 1-9.

1. No.	Born.	No. 572. 26 Oct. 1919. (Figs. 1-9.)
2. Age.	Sex.	Age 5 $\frac{1}{2}$. Sex F.
2a.	Difference in age cf. with next child older.	
3. Occlusion.		Normal (slight tendency to distal on left side).
4. Type of individual.		Lateral.
5. Sitting height.		60.5 cm.
6. Weight (in clothes).		20.42 kg.
7. Normal weight for sitting height.		18.99 kg.
8. Actual weight in relation to normal weight for sitting height.		+ 1.43 kg. Slightly over- weight for both age and sitting height.
9. Walked at.		
10. Knock knees.		No.
11. Flat feet.		No.
14. Ante-natal factors.		Maternal health good.
15. Factors at birth.		Normal—Infantile jaundice.
16. Post-natal factors.		Digestive troubles almost immediately after birth.
17. Weight at birth.		7 lbs.
19. Diet first year.		Bottle fed from birth (nat- ural 9 days). Various artificial foods, but suc- cess with Fairchild's pep- togenic powder and cow's milk only.
20. Diet 2nd-6th years.		Normal; always avoiding excessive sugar. Present time: ordinary diet; very little meat; sweets — few; fruit — ample.
21. Diet after 6 years.		Always excellent; slow eater.
22. Mastication.		

FAMILY No. 3.
ONE CHILD. FIGS. 22-26a.

There are five others not
reported on.

No. 860. (Figs. 22-26a).
Born 11 May 1916.

Age 8 $\frac{2}{3}$. Sex F.

2 $\frac{1}{2}$ years (about).

Class II. Div. I. Very small
arches, overbite correct.
Poor quality teeth.
Linear—very small for age,
mentally very bright.
Shorter than her younger
brother.

Yes.

Yes.

Mother nervous on account
of air raids, and nursed
the father who had
pleurisy. ("Causes of
Feebleness of Growth."—
Jansen.)
Lived on the river during
earliest years which did
not suit the child's health,
which has much im-
proved since living on the
Northern Heights.

FAMILY No. 1—*continued.*

23. Comforter.	Never.
24. (i) Breathing—day.	Normal.
24. (ii) Breathing—night	Very slight inclination to mouth breathing at times.
25. Adenoids.	No.
26. Tonsils.	Possibly rather large.
28. Habits.	Induced sleep by sucking fingers till 3 years of age, and cuddling eiderdown.
30. Illnesses.	None, except slight susceptibility to cold and digestive troubles.
31. Heredity.	Paternal grandfather exceptional teeth. Parents' occlusion. Father normal (approximately). Mother Class II. Div. II.

FAMILY No. 3—*continued.*

No.	
	Sucked two or three fingers, and still does so.
	Father believes the condition hereditary, and accentuated by sucking habit.
	Parents' occlusion. Class I., relation of father's upper and lower incisors similar to the daughter's, but lower lip does not fall so far back; he has a good chin.

33. SUMMARY AND CONCLUSIONS.

"Due to bad nursing the mother's health after birth was very bad for some years; child could not be breast fed, and for some months no satisfactory food could be found. At one time the child was almost despaired of, and was sub-normal in nearly all respects. Careful attention by a trained nurse resulted in a complete change, and at about 18-24 months the child had become fully normal. She is now in excellent health." Quotation from the father's notes.

This child was born strong and healthy; the early digestive troubles (including artificial feeding) and finger sucking do not appear to have had any, or extremely little, harmful effect on the occlusion.

SUMMARY.

The father does not believe that rapid succession of children is detrimental to the later ones, and in his own children has proved to his satisfaction that it is not so.

In this case the antenatal factors seemed to be against the child, and after she was born the neighbourhood did not suit her.

Some of the other children are reported to have good occlusions.

Parents well-to-do. Antenatal overstrain of mother probably an etiological factor.

FAMILY No. 2. THREE CHILDREN. FIGS. 10-18.

1.	No. 868. (Figs. 10-12.) Born 9 Aug. 1906. Age 18. Sex M.	No. 869. (Figs. 13-15.) Born 24 June 1910. Age 14. Sex M. 3 $\frac{1}{2}$ years.	No. 870. (Figs. 16-18.) Born 18 Aug. 1912. Age 12. Sex M. 2 $\frac{1}{2}$ years.
2a. Difference in age <i>cf.</i> with next child older.	Class I. Slight case. Incisors a little crowded.	Class II. Div. I.	Normal.
3. Occlusion.	Linear; has grown 12 in. to 18 in. in last 3 years.	Overbite normal	Lateral, broad, biggest head, thickest set.
4. Type of individual.	864 mm. (Total height 5 ft. 7 $\frac{1}{2}$ in.) 56.80 k. (125 $\frac{1}{4}$ lbs.)	725 mm. (Total height 4 ft. 11 in.) 34.24 k. (75 $\frac{1}{2}$ lbs.) Too short for his age. Too light for his age, but slightly over weight for his sitting height.	667 mm. (Total height 4 ft. 5 in.) 28.35 k. (62 $\frac{1}{2}$ lbs.) Too short for his age. Too light for his age, but rather over weight for his sitting height.
12. Dynamometer pressures —Jaw. Other Pressures.	Good. A little low, especially tongue.	Right molar is only 90 per cent., left one is 140 per cent. All above 100 per cent., but he is short for his age and this makes the figures higher than if age were the basis of comparison.	109 per cent. All above 100 per cent. except tongue which is 99 per cent.
13. Facial Measurements —Vertical. Forward.	Mother had help before birth. Not natural. Natural. Mother thinks it was insufficient. Difficult to get him to eat. Most difficult of the three to bring up till 9 years of age. Nibbled crusts but would not eat good meals.	Mother had help before birth. Natural. Entirely artificial; Nestle's milk, barley water, lime water. No trouble with food; crusts, etc. No raw apples. Bones to bite.	Nasion to upper incisor and to chin too short; lower incisor to chin slight excess. All higher than Campion's figures, but this boy a little older than his group. Mother had help before birth. Natural. Artificial entirely: Nestle's milk, barley water, lime water. No trouble with food; hard crusts etc. No raw apples. Bones to bite.
14. Ante-natal factors.			
15. Factors at birth.			
19. Diet 1st year.			
20. Diet 2nd to 6th years.			

FAMILY No. 2—*continued*.

21. Diet after 6 years,	Good meat eater. Plenty of cooked vegetables, raw apples in quantity. Very few sweets.	Good meat eater. Plenty of cooked vegetables and raw apples. Very few sweets.	Best meat eater of the three. Plenty of cooked vegetables and raw apples. Very few sweets.
22. Mastication.	Slow eater.	Tends to bolt food.	Average.
23. Comforter.	No.	From 1 to 3 years on going to sleep day or night; mother removed it when asleep, but difficult to break him of it.	From birth to 4 on going to sleep day or night; mother removed it when he was asleep.
24. (i) Breathing—day.	Not noticed.	Not noticed.	Not noticed.
24. (ii) Breathing—night.	Mouth breather from four years. Slept with mouth open. Worst of the three. Unpleasant to see him at night on account of choking sound.	Lips apart when at rest.	Slept with mouth open.
25. Adenoids.	} Removed 1918. The worst of the three and never had a comforter.	Removed 1918.	Removed 1920.
26. Tonsils.			
30. Illnesses.			
31. Heredity.	Father's occlusion. Slight open bite, no overlap of incisors. Class uncertain—probably Class I.; too many teeth out. Mother's teeth all artificial.		Removed 1920. Removed 1920. Not vaccinated.

33. SUMMARY AND CONCLUSIONS.

All mouth breathers. 869 and 870 had comforters. 869 Class II. and 870 normal; both fed artificially.

868. Class I. Nearly normal. Birth not natural. Poor chewer. Physical tests not quite as good as the brothers. The mother considers he was not nourished properly owing to her inexperience.

869. Class II. Birth natural. Tends to bolt. Physical tests good.

870. Normal. Birth natural. Mastication average. Best in physical tests.

Environment of all the same; mouth breathing has had little or no effect, certainly in the eldest and youngest. The two younger boys do not appear to have been troubled so much as the eldest one. Chewing may be responsible for the eldest; some cause for the second being Class II. which does not become apparent from the inquiries. As the third child will apparently have an almost perfect or normal occlusion, it may be that the type of the individual is a factor in the probability of good occlusion. Is this a factor which is established after birth, or at the time of conception, or in the intervening period? We should make a big advance if this point could be established. The graph of physical tests (Fig. 20) shows that the results improve in each successive child. (*Vide* note above—*re* dynamometer pressures of 869).

FAMILY No. 4. THREE CHILDREN. FIGS. 27-38.

1. No. Born.	No. 4 L.H. (Figs. 27-30.) Born 6 June 1915. Age 9 $\frac{6}{12}$. Sex F.	No. 5 L.H. (Figs. 31-34.) Born 5 July 1916. Age 8 $\frac{5}{12}$. Sex M. 13 months.	No. 10 L.H. (Figs. 35-38.) Born 29 Sept. 1919. Age 5 $\frac{3}{12}$. Sex M. 3 $\frac{3}{12}$.
2. Age. 2a. Difference in age <i>cf.</i> with next child older.	Sex.		
3. Occlusion.	Class II. Div. I.	Cl. II. Div. I. Severe case (not typical)	Normal.
4. Type of individual.	Lateral.	Lateral.	Lateral.
8. Actual weight in relation to normal weight for sitting height.	+ .78 k.	+ 2.48 k. Sitting height too low for age. Weight too low for age but high for sitting height.	+ 3.89 k.* Weight correct for age. * Compared with female, so is higher than normal.
9. Walked at	1 year.	11 months.	1 year.
12. Physical tests.	Five out of eight 100 per cent. or over.	Eight out of nine 100 per cent. or over.	Seven out of nine 100 per cent. or over
14. Ante-natal factors.		Mother worked for 8 months before child born—no rest.	
15. Factors at birth.	Vertex presentation.	Vertex presentation.	
16. Post-natal factors.		Mother worked after child born (out daily). Mother always had very good health.	
17. Weight at birth.	10 lbs.		
19. Diet 1st year.	Natural 6 weeks, then mother out to work. Cow's milk and barley water.	Natural—1 year.	Natural—9 months.
21. Diet after 6 years.	Sweets—few; fruit—apples.	Sweets—few; fruit—apples.	Sweets—few; fruit—apples.
22. Mastication.	Good—best of three—eats up crusts.	Good, but probably the worst— most faddy.	Good—mother thinks he will be the best chewer.
23. Comforter	None.	None.	None.
24. (i) Breathing—day.	Upper lip always goes up.	Nose.	Nose.
24. (ii) Breathing—night.	Always slept with mouth open.	Nose.	Nose.
28. Habits.	Sucked thumb; started at 3 months.	Grating of teeth at night.	
30. Illnesses.	Chest complaints; bronchitis, whooping cough.	Colds, measles, whooping cough.	Colds, measles, whooping cough.
32. Other factors.	Mother noticed prominence in re- gion of deciduous upper teeth before thumb sucked or teeth appeared.		

The eldest, Class II. Div. I. makes the worst showing in the physical tests, and the second one the best, perhaps due to his total height being below the average for his age, and disturbs the correlation of the figures, though the youngest, who is normal, is probably equally good, but it appears worse in the graph as his age (5 $\frac{1}{2}$) might account for a difficulty in using his strength to the best advantage. The interesting child in this group is the second, born just over a year after his sister, and the mother out at work all day before he was born, a combination which Jansen regards as favourable to feebleness of growth. Is it not possible that, had this boy been born in circumstances similar to those of his younger brother, he would have had an equally good occlusion? Graphs (Figs. 107 and 108) comparing Nos. 572, 862, and 10 L.H., cause a doubt as to whether No. 10 L.H. is quite normal; perhaps he may be a little sub-normal. Comparisons of this nature should help us in early diagnosis of cases on the border line.

FAMILY No. 5. TWO CHILDREN. FIGS. 41-44.


1. No.	Born	No. 736. (Fig. 41-42.)	Born 15 Sept. 1913.	No. 737. (Fig. 43-44.)	Born 25 Aug. 1914.
2. Age	Sex	Age 10 $\frac{3}{4}$.	Sex F.	Age 9 $\frac{4}{12}$.	Sex F.
2a. Difference in age <i>cf.</i> with next child older.		2 years.		11 months.	
3. Occlusion.		Class I.—Arches slightly small. $\frac{6e}{c} \frac{1}{c} \frac{e6}{c}$ are lingual to $\frac{6}{c} \frac{1}{c} \frac{c}{c}$ are in normal relation. Overbite correct; total amount of malocclusion not serious. Width of $\frac{1}{c} = 8.2$ mm.		Class II. Div. II.—Overbite more than No. 736, but upper arch of similar type.	
4. Type of individual.		Condition of mouth very good.		Width of $\frac{1}{c} = 7.5$ mm.	
9. Walked at		Lateral.		Condition of mouth very good.	
10. Knock knees.		2 years.		1 year 3 months.	
11. Flat feet.		No.		No.	
14. Ante-natal factors.		No.		Quite normal.	
15. Factors at birth.		Quite normal.		Normal.	
16. Post-natal factors.		Normal and healthy.		Normal.	
19. Diet 1st year.		Bottle fed entirely on cow's milk and Kepler's malt, 9 months.		Natural feeding.	
21. Diet after 6 years.		An ordinary diet, including home-made brown bread, much milk, no sweets, apples nearly all the year round.		Same as for 736.	

33. SUMMARY AND CONCLUSIONS.

Two sisters, brought up together in Devonshire, less than 1 year's difference in age; the elder, bottle fed entirely for 1 year, has by far the better occlusion; the younger, fed naturally for 1 year, is a case of Class II. Div. II. The history of these children is scanty, but the noticeable feature is that the younger one, the one who is Class II. was born within a year of her elder sister, which brings into operation one of Jansen's factors of feebleness of growth, a tired uterus and possible overstrain of the mother before the child was born on account of looking after the elder sister; it should be recognised that this latter factor is of less importance in children of well-to-do parents, such as these, than it is in cases where the parents are not so well provided with servants and other comforts. Environment, local conditions and diet, except as mentioned, are identical, and age is almost so. If natural feeding or bottle feeding have respectively good and bad effects they do not appear in this instance; in fact, if any argument could be used on this score it would be in the reverse manner. It is difficult to ascribe a cause of the malocclusions and their differences in these two cases; the only factor left to suggest is the enfeebled condition of the mother resulting in feebleness of growth, as expressed by the occlusion Class II. Div. II. One has not been able to discover any factor operating after birth to account for the different occlusions, and one falls back on an ante-natal cause.

FAMILY No. 6. TWO CHILDREN. FIGS. 45-49.

There are three other sisters not reported on.

1. No.	Born.	No. 660. (Figs. 45-46.)	No. 865. (Figs. 47-49)
2. Age.  Sex.		Born 5 Oct. 1914.	Born. 27 Sept. 1917.
2a. Difference in age cf. with next child older.		Age $10\frac{2}{12}$. Sex F.	Age $7\frac{1}{12}$. Sex F.
3. Occlusion.		$1\frac{5}{12}$ (2nd child).	$1\frac{8}{12}$ (4th child).
5. Sitting height.		Class I. Small arches.	Class II. Div. II. Uni-
7. Normal weight for sitting height.		Overbite correct. (Models taken at <i>æt.</i> 8 years).	lateral on right; other- wise similar to 660.
19. Diet 1st year.		67.25 c.m.	60 c.m.
20. Diet 2nd to 6th years.		26.6 k.	18.49 k.
		Weight 29.03 k. = +2.43.	Weight 23.13 k. = +4.64.
		For her age her sitting height is low. Her weight is approximately correct for age, but too heavy for her sitting height.	Her sitting height is too low for her age. She is a little heavy for her age, but decidedly heavy for her sitting height.
23. Comforter.		Bottle fed, Savory & Moore.	Bottle fed, Savory & Moore.
24. (i) Breathing—day.		Meat, vegetables, cooked fruit. Raw apples not more than 2 days a week.	Meat, vegetables, cooked fruit. Raw apples not more than 2 days a week.
24. (ii) Breathing—night		Sweets very seldom.	Sweets very seldom.
28. Habits.		No.	Very feeble; nothing for her to be 1 hr. 20 mins. for lunch.
30. Illnesses.		Nose. { Windows wide open day and night.	No.
		Nose.	Nose. { Windows wide open day and night.
		Sucked lips. Sucked sheets or anything she could get. Just stopped this at 10 years.	Sucked lips, sheets or any- thing she could get; stopped lip-sucking at 6 years and sheets at 4 years.
		General health very good.	General health very good.
			\overline{r} width 5 mm.
			\overline{e} width = 29.5.

33. SUMMARY AND CONCLUSIONS.

There are five sisters in this family born of well-to-do parents between 1913 and 1921 inclusive.

The one fact common to all is that they have a very poor idea of chewing food. Lunch lasts from 1 p.m. to 2.20; they are practically all the same and become a little quicker as they get older. The nurse reports that the eldest has a slight upper prominence and was treated for flat feet for two years, has a double squint and is the most nervy, and that the third child, born $1\frac{3}{12}$ years after No. 660, is practically perfect; these two have not been seen. One would have liked to draw the inference that the poor chewing powers were a factor, but two others have good occlusions (from the report) who were similar in this respect; or if the slow chewing is looked on as a sign of good mastication, then it has only produced two good occlusions instead of four. It is also to be noticed that the third sister, born only $1\frac{3}{12}$ years after the second, is reported to have a good occlusion, so a rapid succession has not had a detrimental effect in this instance. This one also had adenoids removed when she was $7\frac{9}{12}$; the nurse does not remember this child breathing with her mouth closed. I draw the inference that the report that the two children mentioned as having good occlusions is substantially correct, or it is probable they would have been seen.

FAMILY No. 7. TWO CHILDREN. FIGS. 50-64.

1. No.	Born.	No. 6. (Figs. 50-56.) Born 17 Oct. 1905.	No. 7. (Figs. 57-64). Born 29 Mar. 1907.
2. Age.	Sex.	Age 19 $\frac{2}{12}$. Sex M.	Age 17 $\frac{9}{12}$. Sex M.
2a. Difference in age cf. with next child older.			1 $\frac{5}{12}$ years.
3. Occlusion.		Normal—not quite perfect, right side perfect, but some teeth on left side tend to be distal, and per- haps overbite slightly excessive.	Class II. Div. I. Unilateral on left about $\frac{3}{4}$ cusp distal; $\frac{6}{8}$ in normal relation; $\frac{4}{4}$ in lingual relation to upper teeth.
4. Type of individual.		Lateral.	Linear.
5. Sitting height.		870 mm. (Total height 5 ft. 6 $\frac{1}{4}$ in.)	900 mm. (Total height 5 ft. 11 $\frac{1}{4}$ in.)
6. Weight in clothes.		63.5 k.	63.5 k.
7. Normal weight for sitting height.		58.02 k.	64.53 k.
8. Actual weight in relation to nor- mal weight for sitting height.		+5.48 k.* *Includes clothes in excess.	—1.03 k.
9. Walked at		10 months.	20 months.
10. Knock knees.		No.	No.
11. Flat feet.		No.	No.
14. Ante-natal factors.		Absolutely normal.	Born at end of sixth month.
15. Factors at birth.		Nil.	Child not expected to live.
16. Post-natal factors.		Nil. Never cried.	Child cried continually.
19. Diet first year.		Natural—9 months.	Naturally a few weeks en- tirely—about 3 months partly; artificial food 12- 18 months, milk only— traces of Mellin's as aper- ient. Feeding was very difficult and parents thank- ful to get anything down.
20. Diet 2nd to 6th years.		Normal.	Normal.
21. Diet after 6 years.		No sweets; eats fruit.	Eats sweets; little fruit.
22. Mastication.		Vigorous.	Rather late in getting on to things which needed to be chewed. Fair only; tended to bolt food.
23. Comforter.		Yes—up to 2 years.	Yes—for 1 year.
24. (i) Breathing, day.		Normal.	Nasal.
24. (ii) „ night.		Normal.	Nasal—occasionally mouth. Never serious.
25. Adenoids.		Operation at 7 or 7 $\frac{6}{12}$.	Operation as soon as recog- nised.
26. Tonsils.		Operation at 7 or 7 $\frac{6}{12}$.	Operation as soon as recog- nised.
27. Nasal obstruction.		None. Damaged nose at 1 $\frac{6}{12}$.	Slight narrowness.
28. Habits.		None.	None.
30. Illnesses.		Meningitis (epidemic) <i>æt</i> 2.	Nothing of importance. R. Ing. Cong. Hernia.
31. Heredity.		Slight narrowness of nose.	Slightly narrow nose.

Father's occlusion. Class II. Div. II. Unilateral distal
on left. *Excessive* overbite.

33. SUMMARY.

The environment of these two children was alike. The normal occlusion boy is heavy for his sitting height; the Class II. boy is below weight by the same comparison; in other words he is taller and slimmer, nearly 6 feet; his vertical facial measurements are all greater than the other's except $\overline{6}$ cusp to edge of mandible which is the same; this seems to point to underdevelopment of the vertical height of the mandible, hence the excessive overbite. The premature birth and difficult feeding in first two years of life appear to be the only factors which might have a bearing on the different occlusions of these two boys. The father's statement that the ante-natal factors in the elder boy's case were "absolutely normal" may be regarded as significant.

FAMILY No. 8. TWO CHILDREN. FIGS. 67-77.

1. No.	Born.	No. 333. (Figs. 67-73.) Born	Age $8\frac{11}{12}$. Sex M.
2. Age.	Sex.	3 Apr. 1911.	No. 898. (Figs. 74-77). Born
2a. Difference in age cf. with next child older.		Age $13\frac{9}{12}$. Sex M.	15 Feb. 1916.
3. Occlusion.		Class II, Div. I. $\overline{6}$ | is 1 cusp distal, $|\overline{6}$ $\frac{1}{2}$ cusp distal and $|\overline{c}$ $\frac{1}{4}$ cusp distal; $\overline{54}$ | $\overline{45}$ are much spaced, also several upper teeth. Overbite slightly excessive but $\overline{21}$ | $\overline{12}$ do not impinge on gum be- hind $\overline{1}$ | $\overline{1}$. Models taken years earlier, when deci- duous molars in position, do not show correspond- ing spaces.	Class I. Nearly normal— upper molar series tend to be lingual to normal to the lower teeth.
4. Type of individual.		Linear.	Lateral.
14. Ante-natal factors.		Normal.	Normal.
15. Factors at birth.		Vertex presentation.	Vertex presentation; hernia.
17. Weight at birth		About 8 lbs.	About 8 lbs.
19. Diet 1st year.		Natural 9 months.	Natural 7 months.
20. Diet 2nd to 6th years.		Three meals a day; very few sweets.	Three meals a day; very few sweets.
22. Mastication.		Medium. Doubtful if he eats crusts for preference.	Medium. Doubtful if he eats crusts for preference.
23. Comforter.		1 year.	2 years. Removed when asleep.
24. (i) Breathing—day.		Nose.	Nose. { May breathe through mouth as lips are kept apart; nose is patent.
24. (ii) Breathing—night.		Nose.	Nose.
25. Adenoids.		None.	None.
26. Tonsils.		None.	None.
27. Nasal obstruction.		None.	None.
28. Habits.			
30. Illnesses.		Croup; whooping cough; chicken-pox; scarlet fever; influenza. Not delicate.	Pneumonia twice; whoop- ing cough; influenza; delicate.
31. Heredity.		Occlusion of father—excellent except one cusp. distal on left side, i.e. Class II, Div. II. Arches good, upper slightly crowded. Occlusion of mother—Class II, Div. I. (not a bad case). $\overline{3}$ | is $\frac{3}{4}$ cusp distal and $|\overline{3}$ 1 cusp distal; overbite slightly excessive; arrangement of teeth similar to that of 333.	

33. SUMMARY AND CONCLUSIONS.

No. 333 is a case of natural feeding for 9 months, but is Class II, Div. I.; there is no history of mouth-breathing, though probably it is one of that type many associate with mouth-breathing. He had a comforter and is a little heavier than normal. In 6 tests of the 9 he is 100 per cent. or over. The spacing in the premolar region is an interesting development. His tongue pressure is 160 %.

No. 898 is probably rickety and also a mouth-breather; he had a comforter for 2 years, yet he has the better occlusion; except for a little narrowness of the upper arch he is practically normal; the upper lip appears to function badly. He is a trifle lighter than normal for his sitting height. In 5 tests of the 9 he is 100 per cent. or over.

In case 333 Class II, Div. I is not connected with mouth-breathing; nor is bottle feeding a factor in the cause of the malocclusion. The weaker boy's occlusion, No. 898, is much the better, though naturally fed a shorter time, a mouth-breather and possibly rickety, so if these are factors in the cause of the malocclusion they are not very potent ones in this case. In the physical tests his record is not quite as good as his Class II, brother. It would seem that if he had as good a constitution as his brother he might have had perfect dentures.

FAMILY No. 9. THREE CHILDREN. FIGS. 90-103.

1.	No. 720. (Figs. 90-93.) Born 21 July 1914. Sex F.	No. 859. (Figs. 94-98.) Born 16 Aug. 1916. Sex F.	No. 862. (Figs. 99-103.) Born 23 Mar. 1919. Sex F.
2.	Age 10 $\frac{4}{12}$.	Age 8 $\frac{3}{12}$.	Age 5 $\frac{8}{12}$.
2a.	Difference in age <i>cf.</i> with next child older.	2 years.	2 $\frac{1}{2}$ years.
3.	Class II. Div. I.	Class II. Div. I. (Slight: nearly Class I.), included in Class I. in Summary.	Normal. N.B. erupting 111.
4.	Linear. Chest measurement a little small for sitting height. Too tall for age. Too heavy for age, but light for sitting height.	Intermediate. Weight slightly high for age, but a little below normal for sitting height.	Lateral. Has never been able to wear cast-off clothes of others. Weight approximately correct for sitting height, too high for age.
9.	12 months.	12 months.	14 months.
12.	Of the nine comparisons only one (tongue) is 100 per cent. or more.	Of the nine comparisons only two are 100 per cent. or more.	Of the nine comparisons 5 exceed 100 per cent.
13.	Vertical—nasion to sub-mental point 100 mm.	Vertical—nasion to sub-mental point 84 mm.	Nasion to sub-mental point 90 mm
	Forward—Transmeatal axis to 11	Forward—Transmeatal axis to 11	Forward—Transmeatal axis to 11
	94 mm.	85.5 mm.	82 mm.
	Transverse—Transmeatal axis 100 mm.	Transverse—Transmeatal axis 98 mm.	Transverse—Transmeatal axis 100 mm.
14.	Mother ill—albuminuria. Induced 2 weeks before term.		Mother perfectly well before, during and after birth.
15.	Vertex presentation.	Vertex presentation.	Born three weeks later than expected; vertex presentation.
16.	7 $\frac{3}{4}$ lbs. (3.5 k.)	Mother ill—albuminuria—after birth 7 $\frac{1}{4}$ lbs. (3.3 k.)	9 $\frac{1}{4}$ lbs. (4.3 k.)
17.	Natural 5 months. Artificial—cow's milk, Scott's oatmeal flour, eggs, etc. Bottle given up at 9-10 m'ths.	Natural 3 months. Artificial—cow's milk, Chapman's wheat food. Bottle given up at 9-10 months.	Natural 2 months. Artificial—cow's milk (diluted and sterilised) Bottle given up at 9-10 months.
18.	Fruit, meat, eggs, crusts, bones.	Ordinary diet, very small appetite; eats little meat; may have suffered from shortage of fat 1917-1918.	Ordinary food; excellent appetite. At 1 year having eggs, fish, meat, etc. Dislikes meat; hardly eats any at all; almost vegetarian from choice. Fond of potatoes, suet puddings, fruit, bread and butter. Very few sweets.
19.	Diet 1st year.		
20.	Diet 2nd to 6th years.		

FAMILY No. 9—*continued*.

21. Diet after 6 years.	Ordinary diet. Fond of meat, fish, fruit; does not care for sweets and puddings.	Always likes crust and toast. Very few sweets. Fruit on all possible occasions.
22. Mastication.	Medium.	Medium.
23. Comforter.	No.	No.
24. (i) Breathing—day.	Nose breather.	Nose breather.
24. (ii) Breathing—night.	Nose breather.	Nose breather.
25. Adenoids.	Removed Jan., 1924. General health since improved.	No.
26. Tonsils.	No.	No.
28. Habits.	Sucked thumb when teething.	None.
30. Illnesses.	Middle ear abscess followed a cold on three occasions.	Always excellent health and spirits. Strong—can walk 7 miles.
	Excellent digestion.	Excellent digestion.
		$\overline{1}$ width 5.5 mm. \overline{e} width 32.4.

A family of three children; all girls, all brought up in exactly the same way; the first child had the worst irregularities, the last is normal; the eldest is narrowest, the third broadest; the first is most under weight, the third normal.

Pressures (Fig. 105) and measurements (Fig. 106).—The first with the worst occlusion is the worst in the physical tests. The third is the best; the interzygomatic width in the youngest is greater than in the eldest and greater than in the middle one. The molar pressures of 720 and 859 may be affected by wearing appliances. Tongue pressure of 859 and 862 both good, 1.72 k. and 1.28 k. respectively.

Ante-natal health of mother best for the third.

At birth the second the lowest weight; (1st .2 k. and 3rd 1.0 k. heavier).

The first was fed naturally longest; the second was a small eater; the third has best appetite, nearly vegetarian.

All nose breathers; first has had adenoids removed.

First and second sucked thumbs.

Second always under weight and small for age till 7; then improved.

The mother says they were all brought up in the same way, but the third seems to have started life better equipped, and in her case the mother's health was perfect before, during and after, and the father also was in better health and not overworked as he had been consistently in the early years of his married life. The air raids did not disturb the mother.

In this family there appears to be a correlation between the general health of the mother and father before and after birth of the children, and the physical and general conditions and the occlusion of the latter, as the conditions applying to the third child were best during the period, and she has a perfect or almost perfect occlusion, and from tests made is nearest to normal; the other two are under treatment for irregularities of the teeth. These two are mentally quicker than the youngest.

It is of interest to note that the mother's sister also has three girls; the two eldest are like the third in this family; but the third one is thin and tiny, being about a head shorter than 862, though approximately the same age.

FAMILY No. 10. THREE CHILDREN. FIGS. 109-118.

1. No.	Born.	No. 1 L.H. (Figs. 109-111.)	Born	No. 2 L.H. (Figs. 112-115.)	Born	No. 3 L.H. (Figs. 116-118.)	Born
2. Age.	Sex.	17 June 1909.	Age 15 $\frac{6}{12}$.	Sex M.	12 Mar. 1911.	Age 13 $\frac{9}{12}$.	Sex M.
2a. Difference in age <i>cf.</i> with next child older.							
3. Occlusion.		Class I. Excessive overbite. tends to be distal.	16	Class II. Div. I. Unilateral. Slight excessive overbite.		Class I. Slight excessive overbite.	
4. Type of individual.		Linear.		Linear. Nearly as tall as his brother who is Class I.		Linear. Sitting height 66.1 c.m. Normal weight for sitting height 25.19k, actual weight 23.6 =— 1.59k. Sitting height much too low for age. Weight slightly too low for sitting height, but much too low for age. 18 months.	
9. Walked at		11 months.		13 months.			
10. Knock knees.		No.		No.			
11. Flat feet.		No.		No.			
19. Diet 1st year.		Natural supplemented by Ridge's food.		Natural.		Natural partly—supplemented by Robinson's barley.	
20. Diet 2nd to 6th years.						Gravy, vegetables and anything ob- tainable. (War time and short of food.	
21. Diet after 6 years.		Ordinary diet; few sweets, fruit preferred.		Ordinary diet; few sweets, fruit preferred.		Slow.	
22. Mastication.		Rather swift.				Nose.	
24. (i) Breathing—day.		Nose.		Nose.		Nose.	
24. (ii) Breathing—night.		Nose.				No trouble.	
25. Adenoids.		No trouble.		Removed age 9.		No trouble.	
26. Tonsils.				Removed age 9.		Sucked two fingers.	
28. Habits.		Measles, chicken-pox.		Measles, chicken-pox.		Measles, whooping cough, chicken- pox.	
30. Illnesses.							

There is an extraordinary similarity in the arches and occlusion of these three children, all with serious malocclusion, but least in the youngest, who sucked two fingers; only one fed entirely naturally for nine months (No. 2. Class II. Div. I.); he has also been a mouth breather in all probability (Fig. 119). There is no difference in the occlusion, which can be ascribed to the oft-quoted causes just referred to, though one might say the girl would not be as bad if she had not sucked her fingers, and that the middle one would have been worse if he had not been breast fed for one year, and again that he would not have been so bad had he not had troublesome tonsils and adenoids. But other cases seem to point to the fact that these three causes have little if any etiological bearing on the problem.

The conclusion one has come to is that the supposed post-natal causes are probably not causes in these three children at all, and that it may be some congenital or hereditary factor; the similarity of the dental arches tempts one to think of the latter.

FAMILY No. 11. FOUR CHILDREN. (Only three have been examined.) FIGS. 122-127.

1.	No. 384. (Figs. 122-123.) Born 28 Dec. 1911. Age 12½. Sex F.	No. 400. (Figs. 124-125.) Born 25 June 1913. Age 11½. Sex F.	No. 873. (Figs. 126-127.) Born 26 July 1916. Age 8½. Sex M.	Rachel. Born 30 Aug. 1922. Age 2½. Sex F. 6½.
2.				
2a.	Difference in age cf. with next child older.			
3.	Occlusion.	Class II. Div. I. and II. One cusp distal on each side. Excessive overbite.	Class II. Div. I. Distal on left, slightly distal on right. 60.9 c.m. 3 st. 4 lbs. 6 ozs. = 21 k. 18.97 k.	This child has not been seen.
5.	Sitting height.		+ 2.03 k. Sitting height far too low for age. Weight too low for age, but high for sitting height.	
6.	Weight in clothes.			
7.	Normal weight for sitting height.			
8.	Actual weight in relation to normal weight for sitting height.			
9.	Walked at	17 months.		15-18 months.
10.	Knock knees.	Yes.		
14.	Ante-natal factors.	Mother lived in Petrograd till 6 weeks before birth.	Mother travelled from Pet- rograd 2 months before birth—10 days' journey —no hardships—mother enjoyed it. Very thin.	Particularly nervous from birth to 4 months.
15.	Factors at birth.			
16.	Post-natal factors.			
17.	Weight at birth.	6 lbs. 12 ozs.	5 lbs. 7 ozs.	7 lbs. 6 ozs.
19.	Diet 1st year.	Natural 6 months. Artifi- cial—cow's milk and Savory & Moore's food.	Natural 4 months, with 1 bottle of cow's milk and citrate of soda daily. Cow's milk diluted; later Chapman's food, Robin- son's groats, Robbs' rusks.	Natural 2 weeks—child did not thrive. Diluted cow's milk and citrate of soda; then milk and albulactin— neither of these digested. At 5 weeks cow's milk and Fairchild's peptonising powders—child started re- covery from this time; powder gradually dropped. Fruit juice daily. Valen- tine's beef juice from 3-6 months. Then Chapman's food, etc.

FAMILY No. 11—*continued*.

20. Diet 2nd to 6th years	All milk boiled (in Petrograd).	Milk boiled till 3 years.	Most trying; no appetite; ate very little.	No food after tea; 1 sweet daily. After 9 months milk not boiled.
21. Diet after 6 years.	No food after tea; sweets seldom; apple or orange daily.	Very fond of meat; no food after tea; sweets seldom; fruit daily.	Ordinary English diet. Overtake after tea; sweets seldom; apple, orange or banana nearly every day.	
22. Mastication.		Masticated nothing till 3½ years; everything washed down liquid till then.	Very slow and small eater.	Mastication excellent.
23. Comforter.			Occasionally for 1 or 2 months.	Occasionally during first few weeks.
25. Adenoids.	Removed 1923 as she had glands in neck; after operation these disappeared.		Removed March 1923, as he got deaf after influenza.	
26. Tonsils.			Removed March 1923.	
28. Habits.	Nail biting till 10; mother did this till 18.			
30. Illnesses.	Worms 1913, whooping cough 1920; mumps 1923.	Bacillus coli (?) in bladder from 6-12 months causing fever and convulsions. Whooping cough 1920, tubercular glands in neck 1921—appeared first after influenza and streptococci. Removed 1922—no further trouble.	Whooping cough 1920; mumps 1923; tonsils and adenoids 1923.	Perfectly normal healthy child from 5 weeks to present time.
31. Heredity.	Rheumatism—complained of pain in legs from 3 years, but not last 2 years.	No tubercular tendency in family.		
32. Other factors.			Very slow development.	

Father's occlusion—Class II. Div. II. Excessive overbite. Mother's occlusion—probably was Class II. Div. I., but not severe. Has lost several teeth.

No. 873 was the smallest at birth; he has the smallest jaws; 400 was the heaviest and had the least crowding, but nevertheless hers was severe; on the other hand she did not masticate anything till 3½ years old, and has probably had the worst illnesses. Had it not been for the lack of mastication and perhaps the illnesses these arches might have been better developed. The histories of these three children are not good, and do not throw light on any etiological factors operating after birth, except for mastication of Nos. 400 and 873, and this, as has been shown, can occur coincidentally with a much better arch (No. 868). Again it would seem we have to fall back on causes operating before birth.

FAMILY No. 12. FOUR CHILDREN.

FIGS. 129-140.

1. No. Born.	No. 600. (Figs. 129-132.) Born 3 June 1913.	No. 626. (Figs. 133-134.) Born 11 Nov. 1916.	No. 648. (Figs. 135-137.) Born 22 Apl. 1918.	No. 746. (Figs. 138-140.) Born 9 Feb. 1921.
2. Age. Sex.	Age 10. Sex F.	Age 7. Sex F.	Age 6. Sex F.	Age 3 $\frac{6}{12}$. Sex F.
2a. Difference in age cf. with next child older.		3 $\frac{5}{12}$.	1 $\frac{5}{12}$.	2 $\frac{9}{12}$.
3. Occlusion.	Class II. Div. I.	Class II. Div. I.	Class II. Div. I.	Class II. Div. I.
4. Type of individual.	Linear.	Linear.	? Lateral.	? Lateral.
9. Walked at	14 months.	17 months.	14 months.	14 months.
10. Knock knees.	Slight.	Slight.	Slight.	Slight.
11. Flat feet.	No.	No.	No.	No.
14. Ante-natal factors.	Health excellent.	Bad attack gall stones 10 months before; husband torpedood; mother thinks these make child's resisting power low.	Health very good in spite of war, rationing, etc.	Health good, but more discomfort than with other three.
15. Factors at birth.	Child very strong and healthy. Mother's age 21.	Healthy, but appetite bad.	Child very healthy and strong.	Breech presentation. Child very healthy and strong.
17. Weight at birth.	7 lbs.	8 lbs.	8 $\frac{1}{2}$ lbs.	9 lbs.
19. Diet 1st year.	Natural 3 weeks. Artificial —Allenbury No. 1. Milk at 6 months.	Natural not at all. Artificial —Allenbury No. 1. Whole milk at 6 months.	Natural not at all. Artificial —milk, water and cream.	Natural not at all. Artificial —milk, water and cream.
20. Diet 2nd-6th years.	Good diet; plenty of fruit and milk. Ordinary plain food; few sweets. Meat, vegetables, bread and butter.	Ordinary plain food; plenty of milk and fruit. After tea bovril. After dinner sweets.	Ordinary plain food; plenty of milk; had fruit, but apparently less than cases 600 and 626. After tea bovril; milk in summer.	Ordinary plain food; plenty of milk. Apparently less fruit than cases 600 and 626. After tea milk—nothing to eat.
21. Diet after six years				
22. Mastication.	Good, and appetite always good; no trouble over eating.	Took hours over meals till 5 years old; mother thinks due to war nerves and her own illness. Appetite so bad that she was taken out of nursery for meals, and it steadily improved. Dislikes "yellow" cakes and puddings.	Good.	Good.
23. Comforter.	No.	No.	No.	No.
24. (i) Breathing—day.	Nose.	Breathed through mouth till adenoids removed.	Nose.	Nose.
24. (i) Breathing—night	Nose.	Breathed through mouth till adenoids removed.	Nose.	Mouth, through thumb-sucking.

FAMILY No. 12—*continued*.

25. Adenoids.	No.	Operation, October 1920.	No.	Doctors say not; snores badly; they say on account of small bridge of nose.
26. Tonsils.	No.	Operation, June, 1922.	No.	No.
27. Nasal obstruction.	No.	No.	Small bridge to nose like father, cases 600 and 746.	
28. Habits.	None.	None.	None.	Began to suck thumb at 18 months; still very bad. If thumb impossible sucks sheet or blanket; never did so as small baby. Does this when resting mid-day and at night.
30. Illnesses.	Scarlet fever, Sept. 1924.	Small naevi removed from back, June 1917.	None.	None.
31. Heredity.	The mother is Class II. Div. I	Peg shaped upper laterals.		

33. SUMMARY AND CONCLUSIONS.

Similar occlusion in all four children; the birth of the one with least resistance (626) coincides with mother's previous ill-health and husband's efforts to be torpedoed. She was a very slow eater till 4 years of age, and a mouth breather for about the same time. She was born in a very cold winter and always feels the cold—she is fair (the others dark and less susceptible to heat and cold). The fair one is different in build, temperament and strength.

All bottle fed (except eldest for three weeks); 648 had difficulty to be clean.

The history of these four sisters is very similar, though the mother thinks 626 has not had as good a chance as the others, and there is less than 8 years between the eldest and the youngest; they have all been brought up together, and we may regard their environment as identical; the occlusion is very similar in all four. In one (626) there are several factors which might be supposed to have a bearing on the problem, but it is doubtful if they have had any effect, because where they were absent in the other children the occlusion is similar; the factors are (1) the mother's impaired health; (2) poor appetite and very slow eater till 4 years of age; (3) mouth breather till 4 years of age. Bottle feeding is common to all and might be a cause, yet previous cases seem to show that bottle feeding is not a factor; therefore one does not seem justified in placing any importance on this.

It may be that there is an hereditary or congenital factor which is not yet clearly identified; it may be a hormone or lack of one, and if so is it a product, or lack of a product, of the mother which should affect the child in utero or is it one produced in the foetus or in the child?

If a hormone is a cause or the cause it would seem to be one affecting the masticatory face more than any other part, for there is no other deformity which strikes an observer in the way that the effects produced by the positions and relations of the teeth do. 600 may be knock kneed (Fig. 132).

There seems a little evidence for believing that there is an hereditary factor as, at least, a part of the cause.



Figs. 1 to 4. Case No. 572. Normal occlusion.

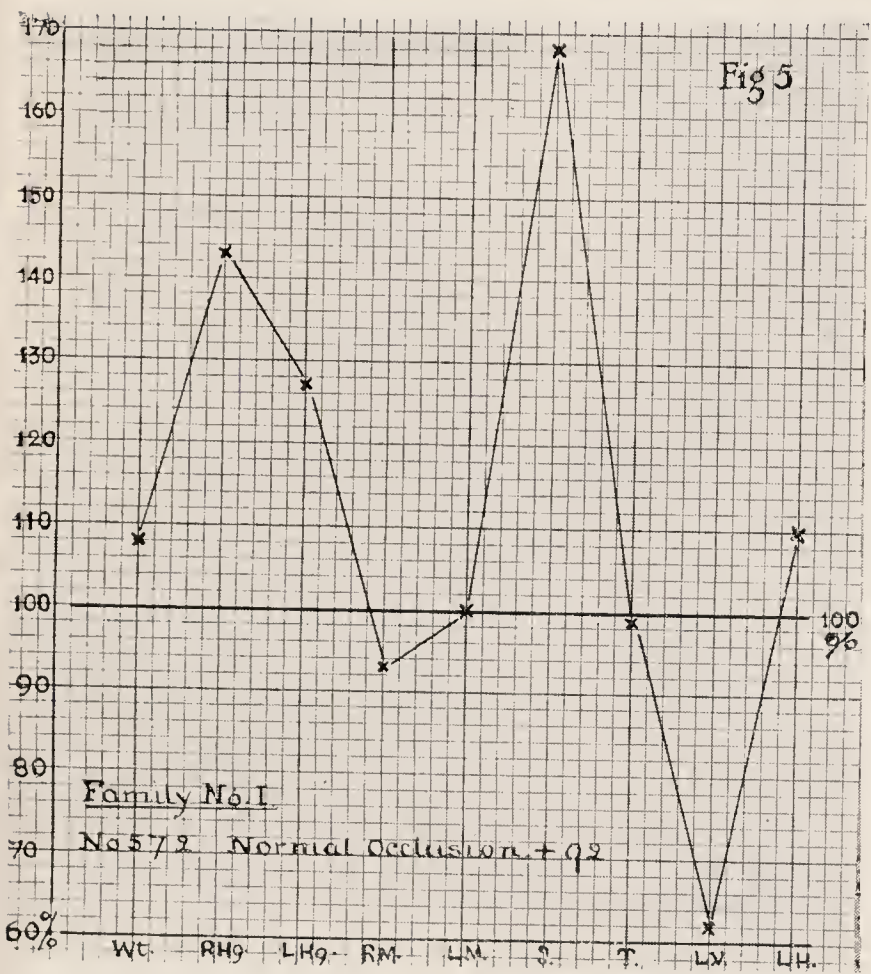


Fig. 6. Father of No. 572. Normal occlusion approximately.



Fig. 7. Father of No. 572. Right side in occlusion.
Figs. 8 and 9. Mother of No. 572. Class II, Division II.



Nos. 10, 11, 12. Class I (slight).
Case 868.

Nos. 13, 14, 15. Class II, Division I
Case 869.

Nos. 16, 17, 18. Normal occlusion.
Case 870



Fig. 18. Normal occlusion.



Fig. 19. Cases Nos. 868, 869 and 870. Each boy standing on same level.

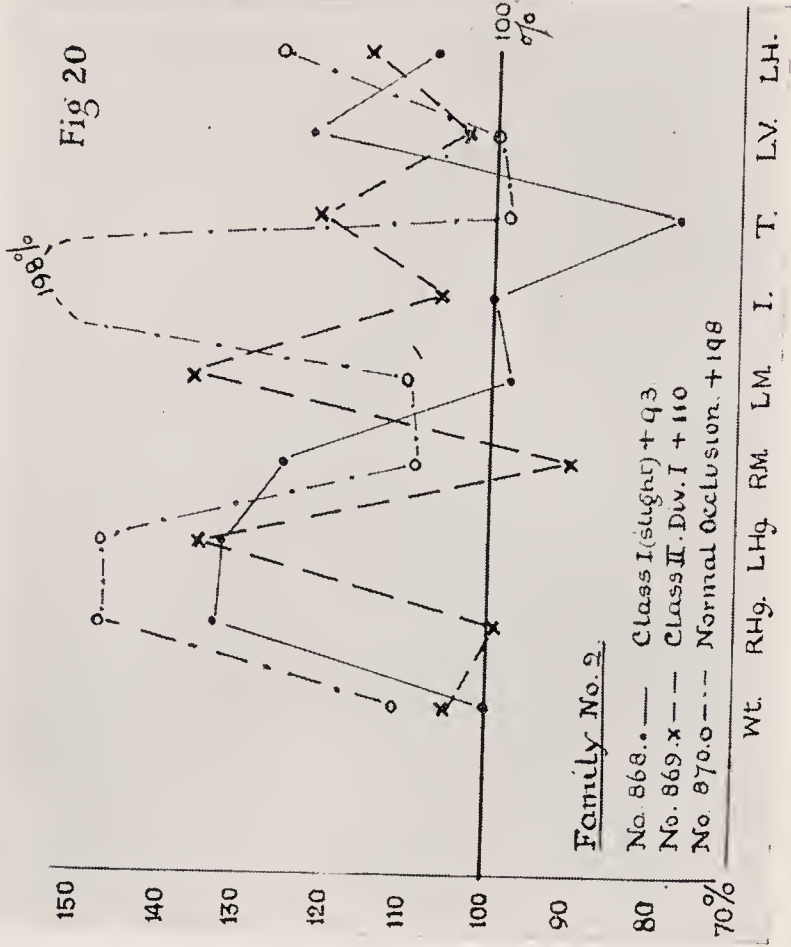


Fig. 20. Graph showing the result of physical tests in family No. 2, Cases 868, 869 and 870. The normal occlusion boy shows the best result and the post-normal boy is second best, but would probably not have been as good as the Class I boy had age and not sitting height been taken as the standard of comparison.

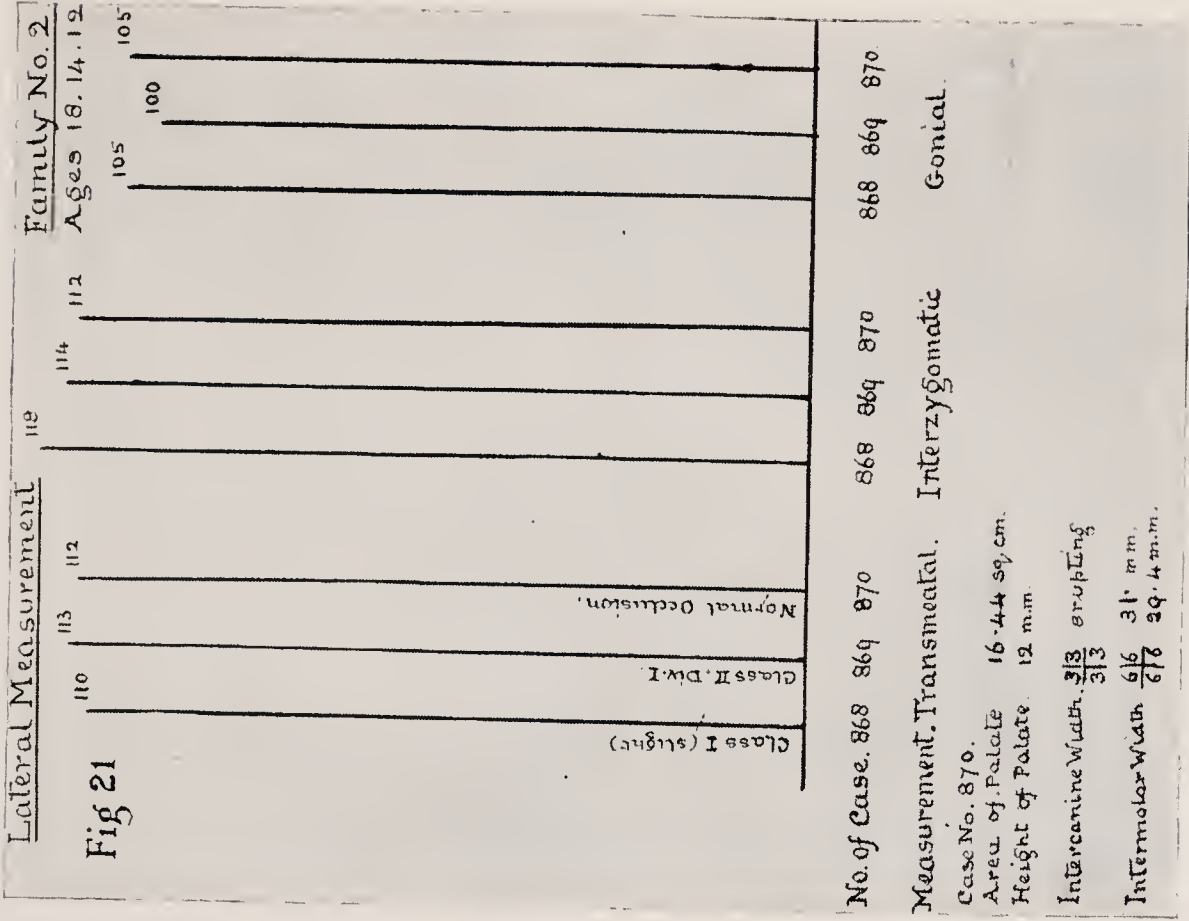


Fig. 21. Graph showing lateral facial measurements of family No. 2.



Figs. 22 to 26a. Case No. 860, Class II, Division I.



Figs. 27, 28, 29 and 30. Case 4 L.H., Class II, Division I.

Figs. 35, 36, 37 and 38. Case No. 10 L.H. Normal occlusion.

Figs. 31, 32, 33 and 34. Case No. 5 L.H., Class II, Division I.
In Fig 29 ordinarily the lips are not closed as shown.

FAMILY No. 4.

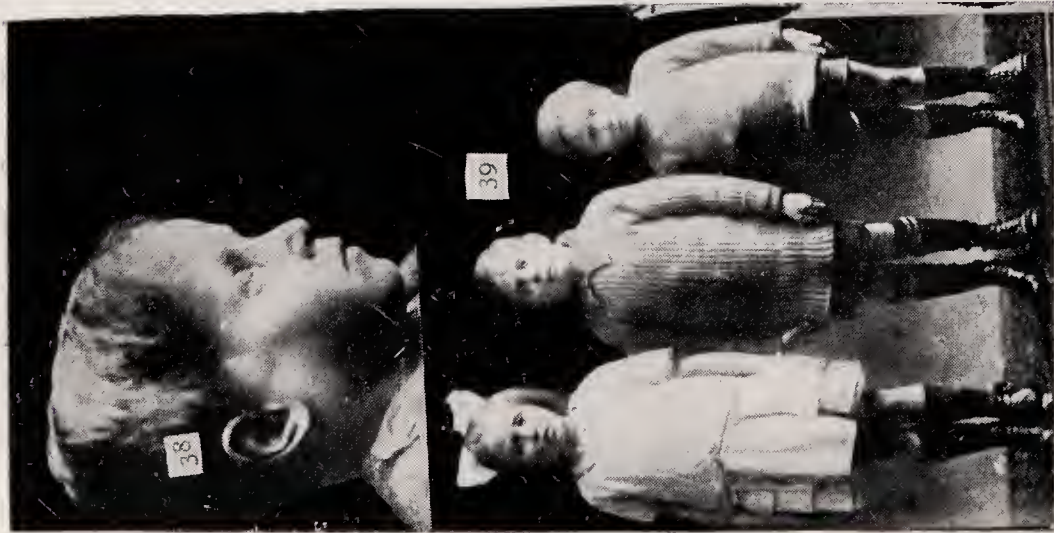


Fig. 38. Case No. 10 L.H. Normal occlusion.

Fig. 39. Cases Nos. L.H. 4, 5 and 10.

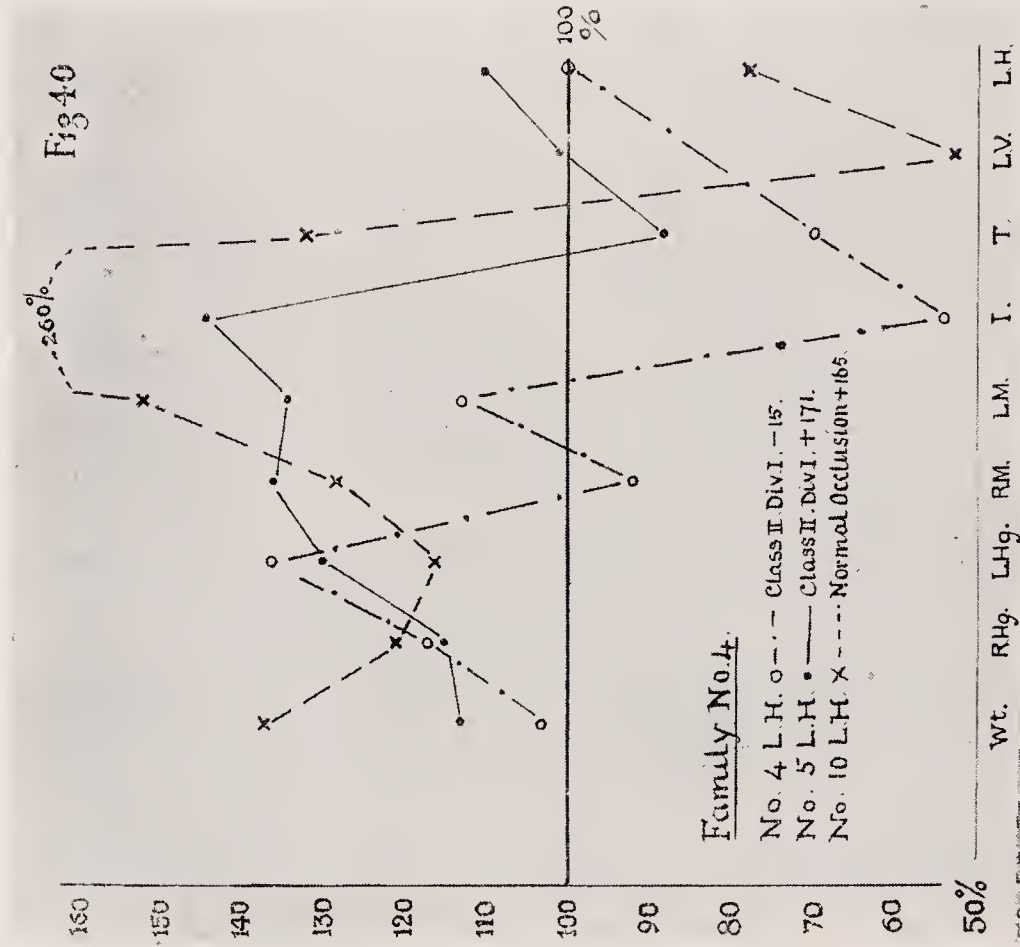
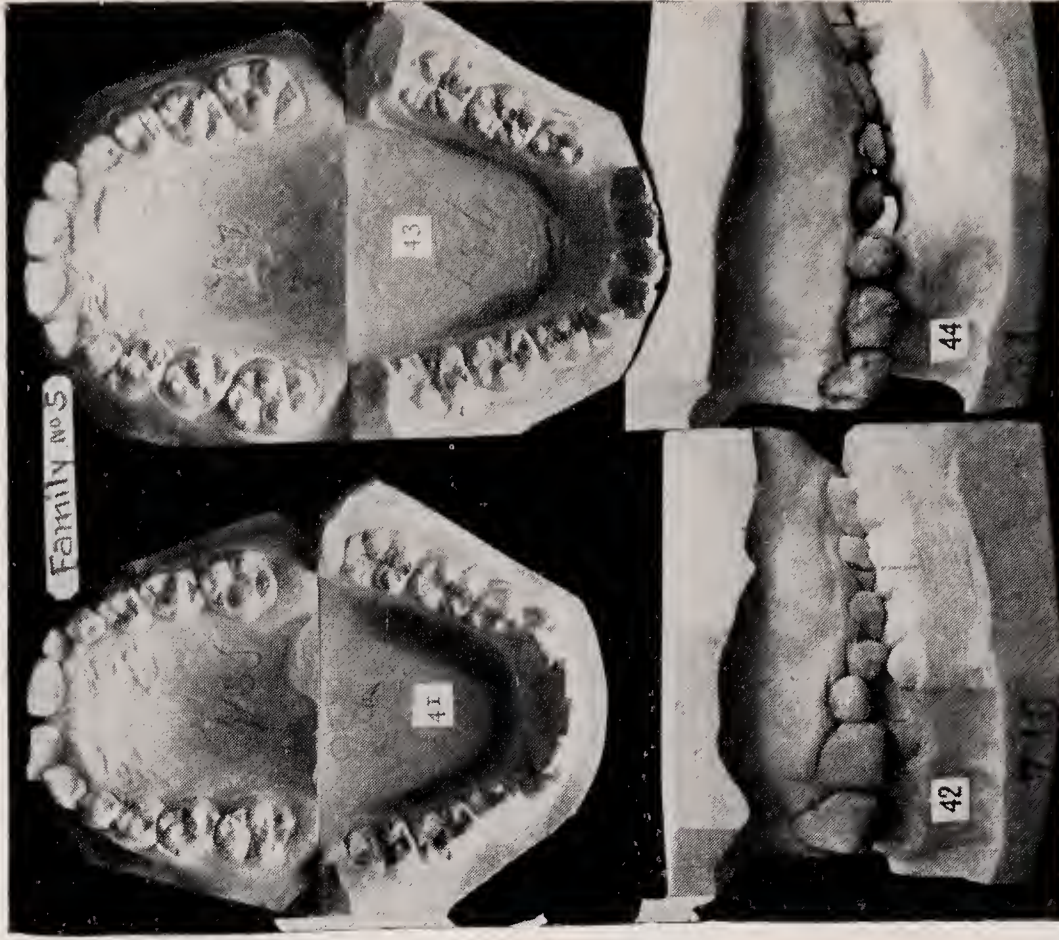
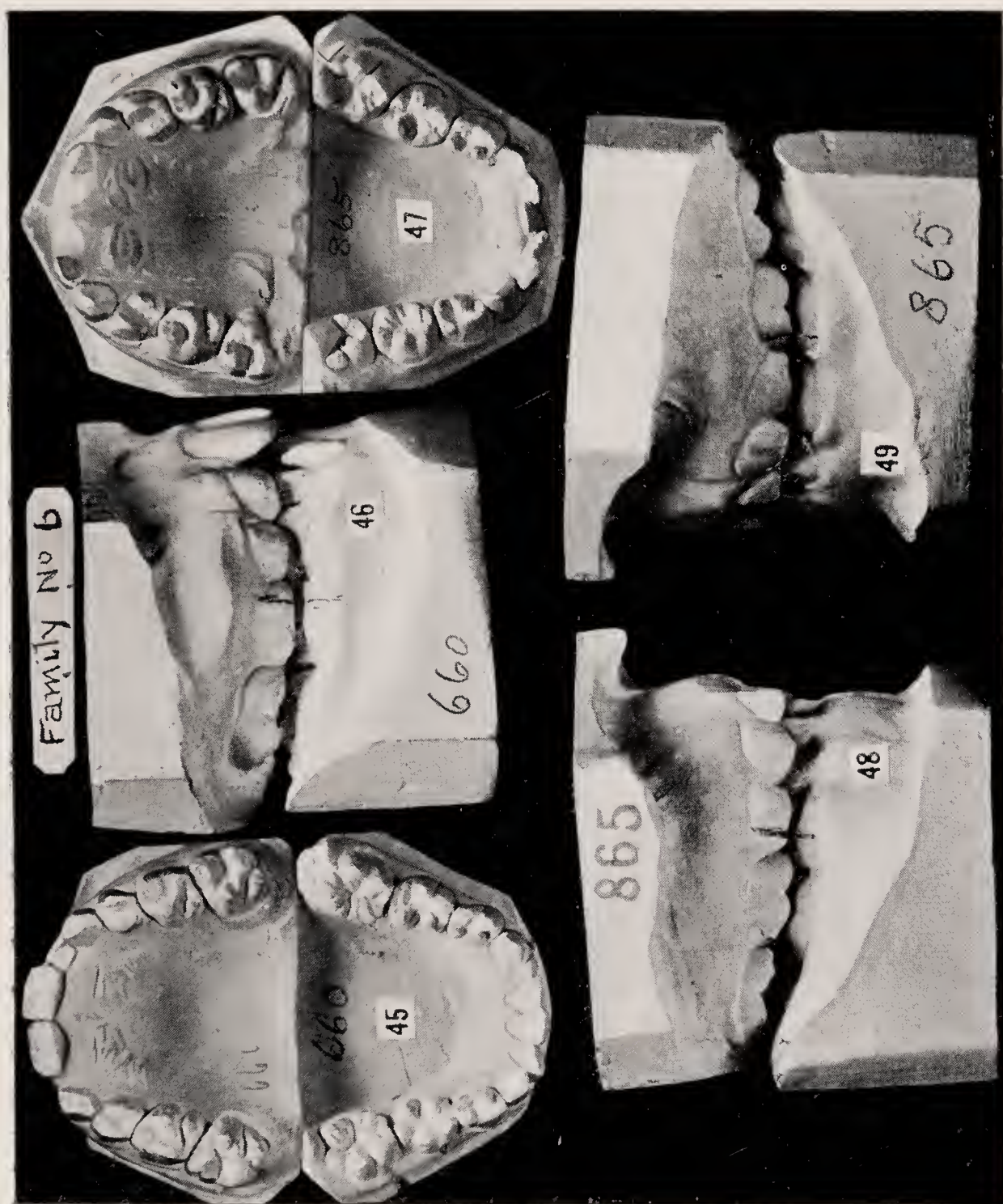


Fig. 40. Graph showing the results of physical tests in family No. 4.

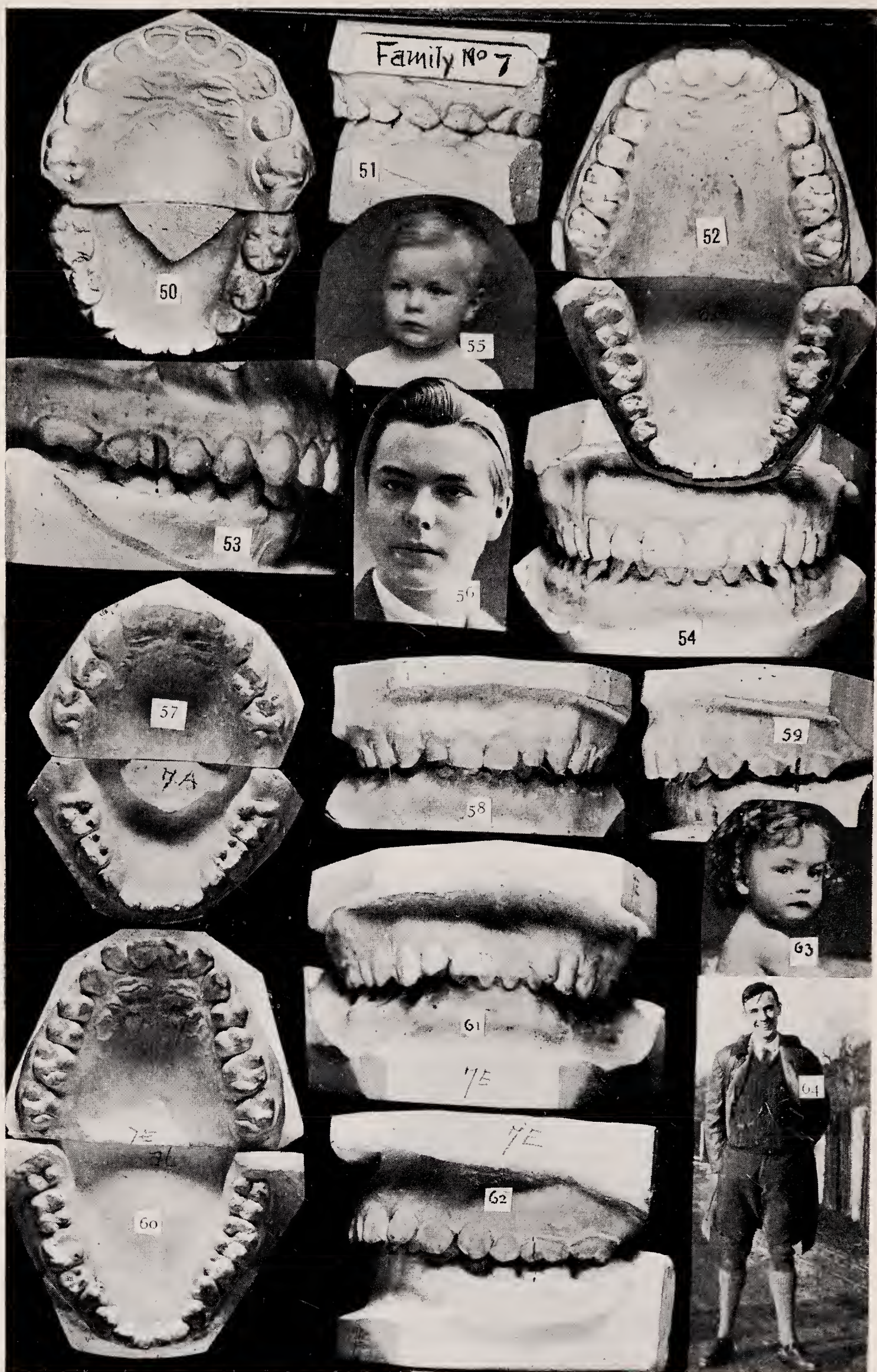
No. 4 L.H. This child was under orthodontic treatment when the tests were made and the tooth pressures undoubtedly reduced thereby. No. 5 probably shows better from the sitting height standard of comparison than he would if the standard had been age.



Figs. 41 and 42. Case No. 736, Class I (slight).
Figs. 43 and 44. Case No. 737, Class II, Division II



Figs. 45 and 46. Case No. 660, Class I, (severe).
 Figs. 47, 48, and 49. Case No. 865, Class II, Division II.



Figs. 50 and 51. Case No. 6. Normal occlusion, age 4.
 Figs. 52, 53 and 54. Normal occlusion, age 19
 Figs. 55 and 56. Case No. 6.
 Figs. 57, 58 and 59. Case No. 7, Class II. Division I. age 4.
 Figs. 60, 61 and 62. Age 17.
 Figs. 63 and 64. Case No. 7.

FAMILY No. 7

Fig. 65. Graph showing the result of physical tests in family No. 7, Cases 6 and 7. The comparisons in this family are probably uninfluenced by factors which may have affected previous ones.

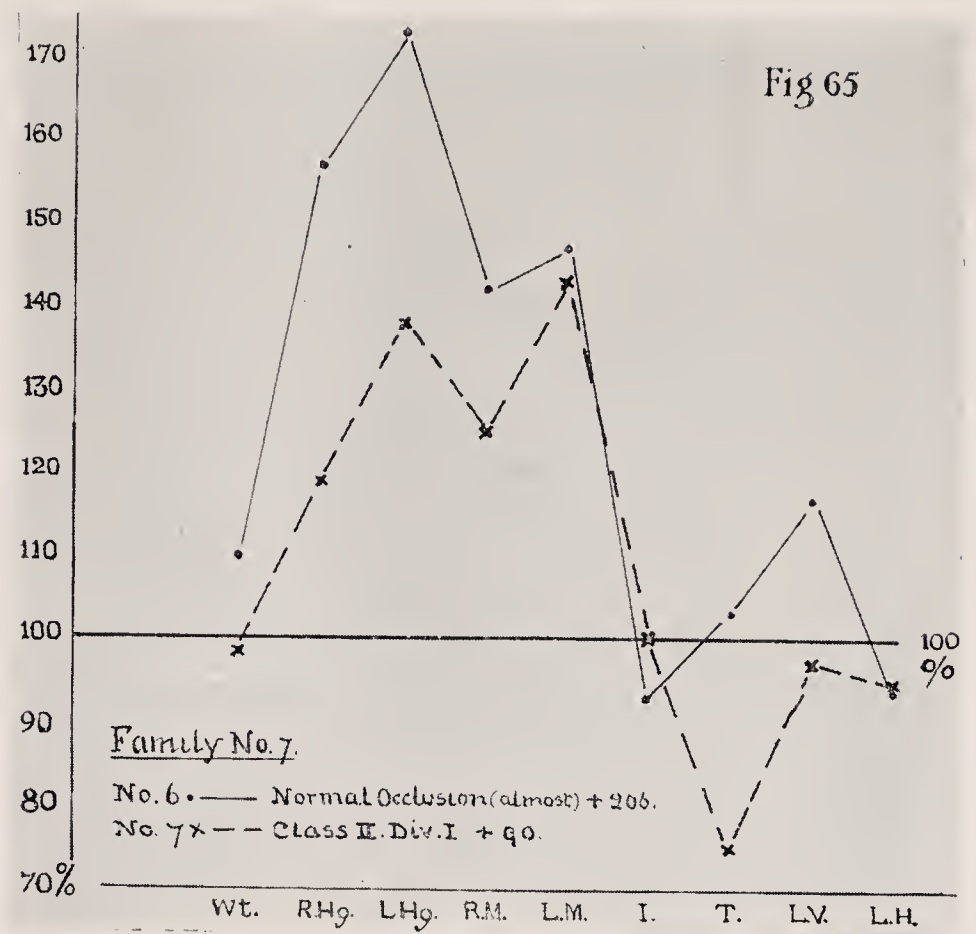
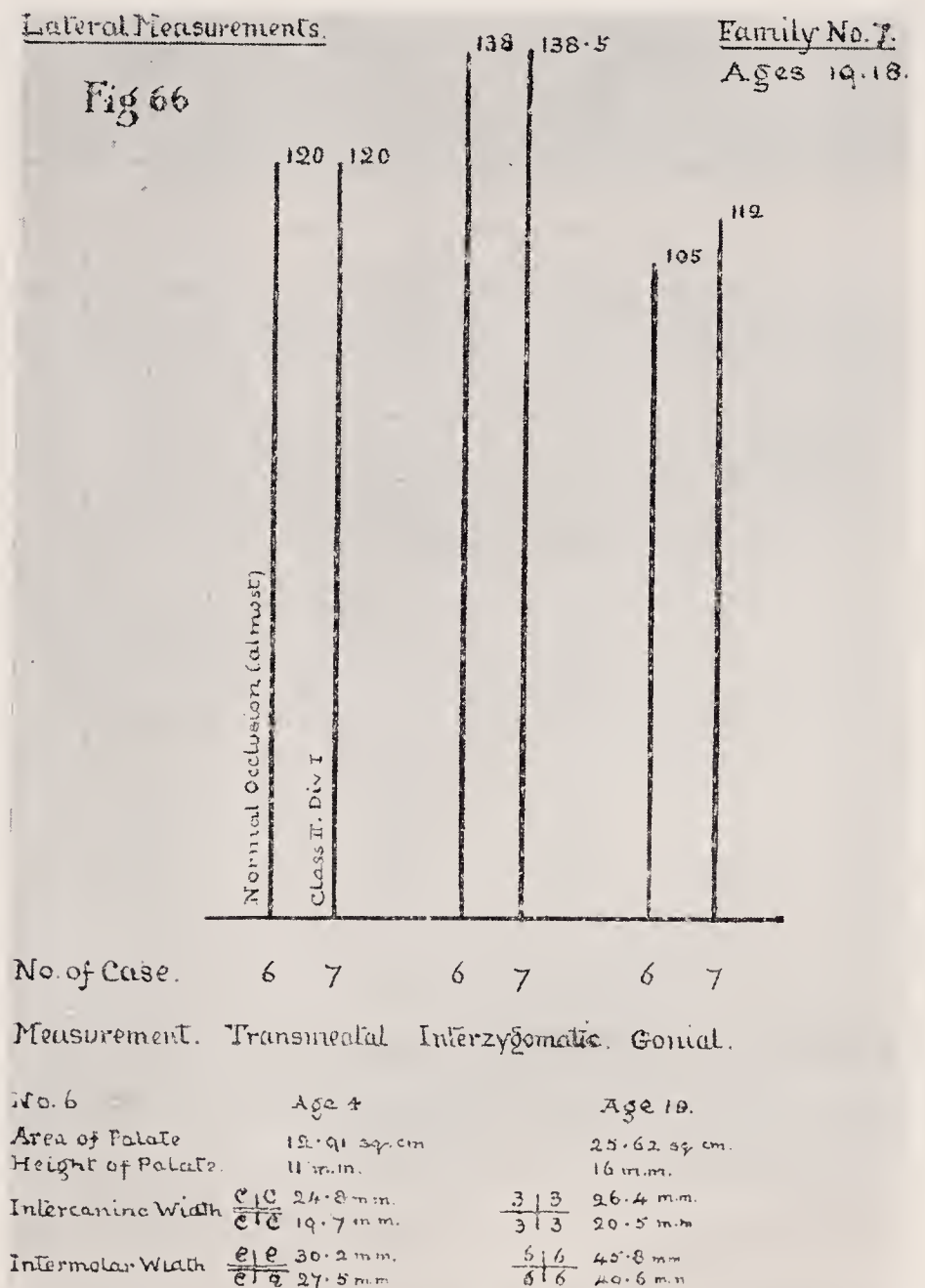
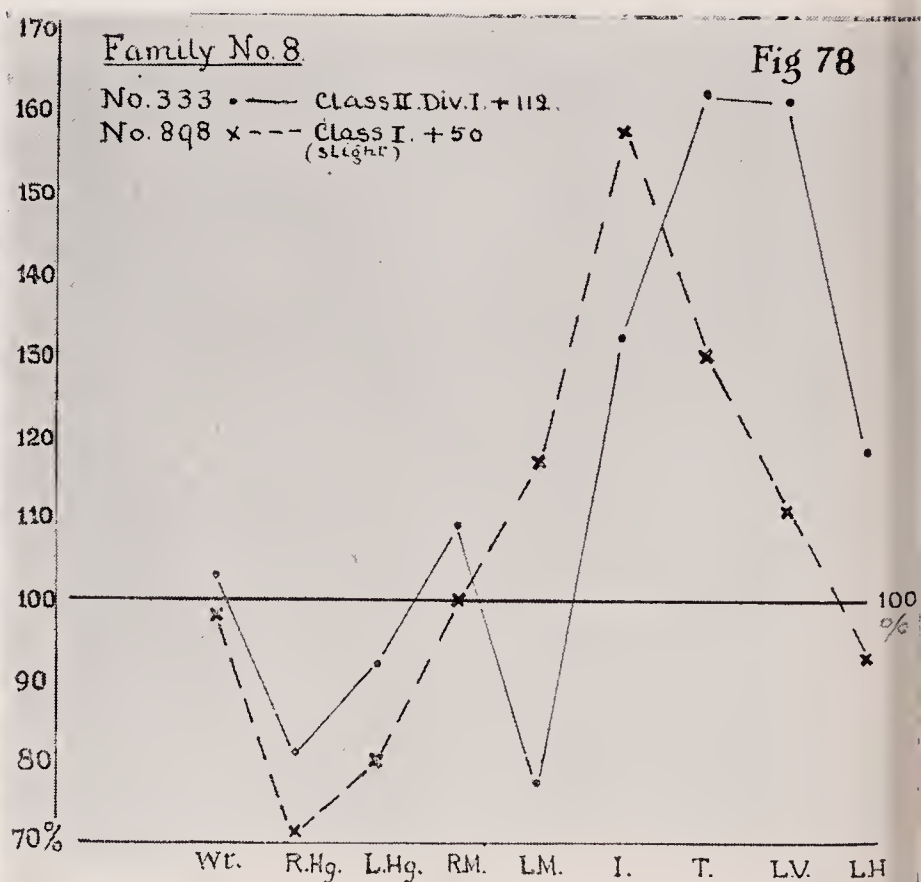
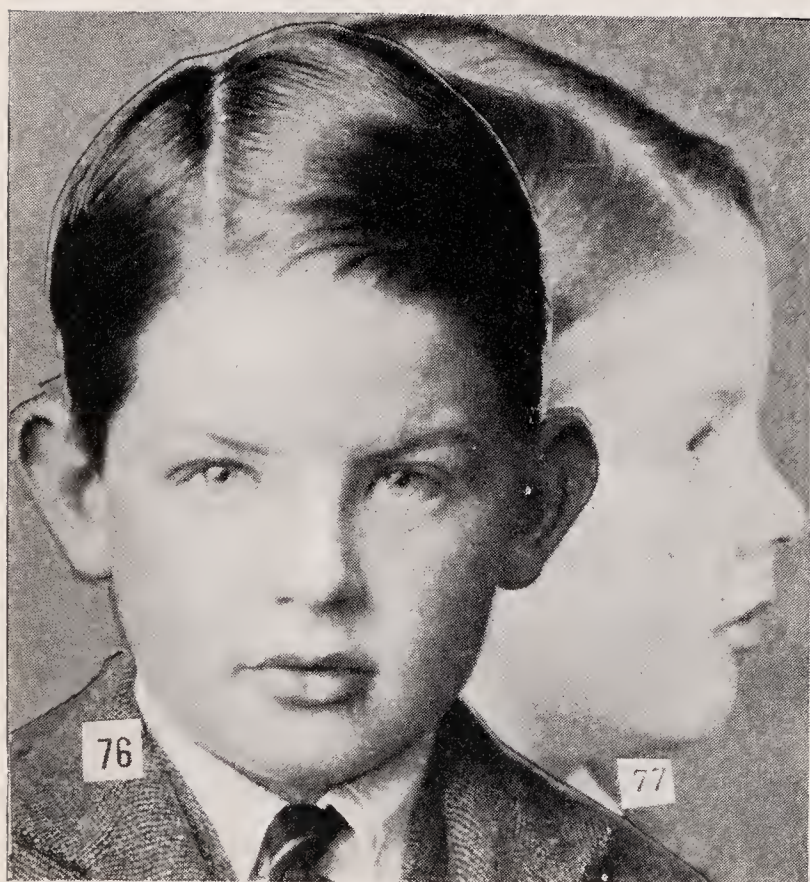


Fig. 66. Graph showing lateral facial measurements of family No. 7, Cases 6 and 7.





Figs. 67 and 68. Case No. 333, Class II. Division I., age 8. Figs. 69, 70, and 71 at age 13. Figs 72 and 73. Case No. 333. Figs. 74, 75, 76 and 77. Case No. 898, Class I. (slight).

Fig. 78. Graph showing the result of physical tests in family No. 8. Cases Nos. 333 and 898. No. 898 is a much more delicate boy than No. 333; the latter in the tests was anxious to beat the published tests of another boy of the same age.

Lateral
Measurements.

Family No. 8.

Ages 14. 9.

Fig 79

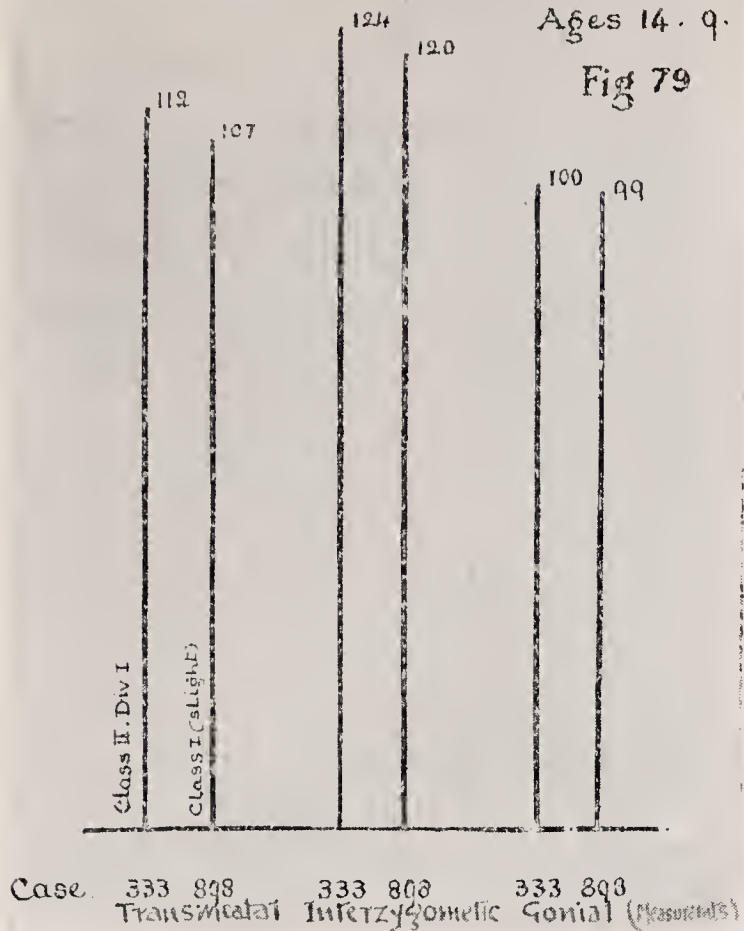


Fig. 79. Showing lateral facial measurements of family No. 8.
Nos. 333 and 898.



Figs. 80, 81 and 82. Mother of Nos. 333 and 898, Class II, Division I.



Figs. 80 and 81. Mother of Nos. 333 and 898, Class II, Division I.
Figs. 83 to 86. Father of Nos. 333 and 898, Class II, Division II (No. 896).

FACIAL MEASUREMENTS.

Fig. 87.

CASE.	No. 6.	No. 7.	No. 896.	Campion's Means.
Total height ..	5' 6 $\frac{1}{4}$ "	5' 11 $\frac{1}{4}$ "	6' 1 $\frac{1}{4}$ "	—
Chest measurement ..	37"	36 $\frac{1}{2}$ "	35"	—
Weight ..	140 lbs.	140 lbs.	137 $\frac{1}{2}$ lbs.	—
Sex ..	M.	M.	M.	—
Age ..	19	18	40	Adult.

MEASUREMENTS—A VERTICAL.

I. Nas. to Sub-Nasal point	47.0	52.3	60.0	A 53.2
III. Nas. to Upp. Inc. (tip)	75.0	76.2	89.0	B 76.7
IV. Nas. to sub-mental pt.	113.0	120.0	128.0	C 122.8
V. L. Inc. (tip) to sub-ment. point ..	41.0	48.0	47.5	D 44.7
VII. 61 cusp to mandible edge	39.0	39.0	—	—

B FORWARD.

I. Trans-meatal axis to—				
Nasion ..	103.0	103.0	100.0	E 100.4
IV. Upper Inc. tip ..	108.5	106.0	100.0	F 100.6
V. Lower Inc. gum ..	110.0	104.0	—	—
VI. Mental eminence..	128.0	125.0	121.0	G 119.9

C LATERAL.

I. Trans-meatal axis ..	120.0	120.0	112.0	—
II. Inter-zygomatic ..	138.0	138.5	122.0	—
III. Gonial ..	105.0	112.0	103.0	—

These measurements are shown graphically in Figs. 88 and 89.

Case No.	6	7	896
Total Height	5' 6 $\frac{1}{4}$ "	5' 11 $\frac{1}{4}$ "	6' 1 $\frac{1}{4}$ "
Chest measures	37"	36 $\frac{1}{2}$ "	35"
Weight	140 lbs.	140 lbs.	137 $\frac{1}{2}$ lbs.
Sex	M	M	M
Age	19	18	40

Fig 89

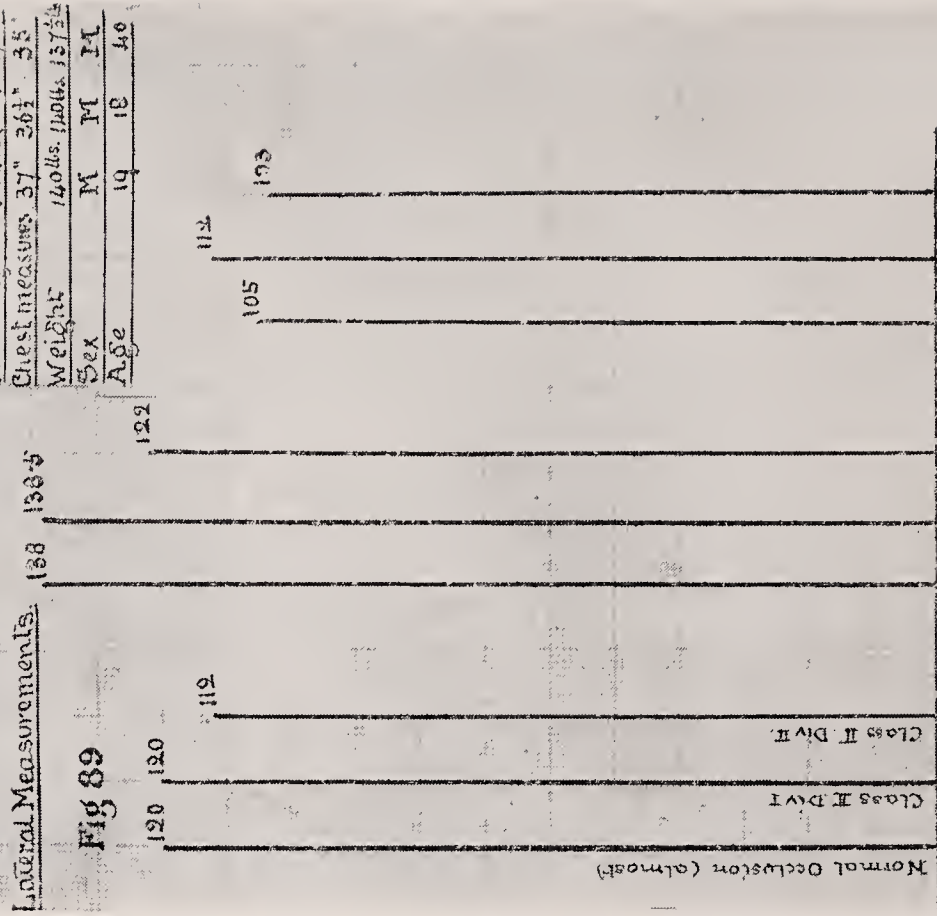


Fig 88

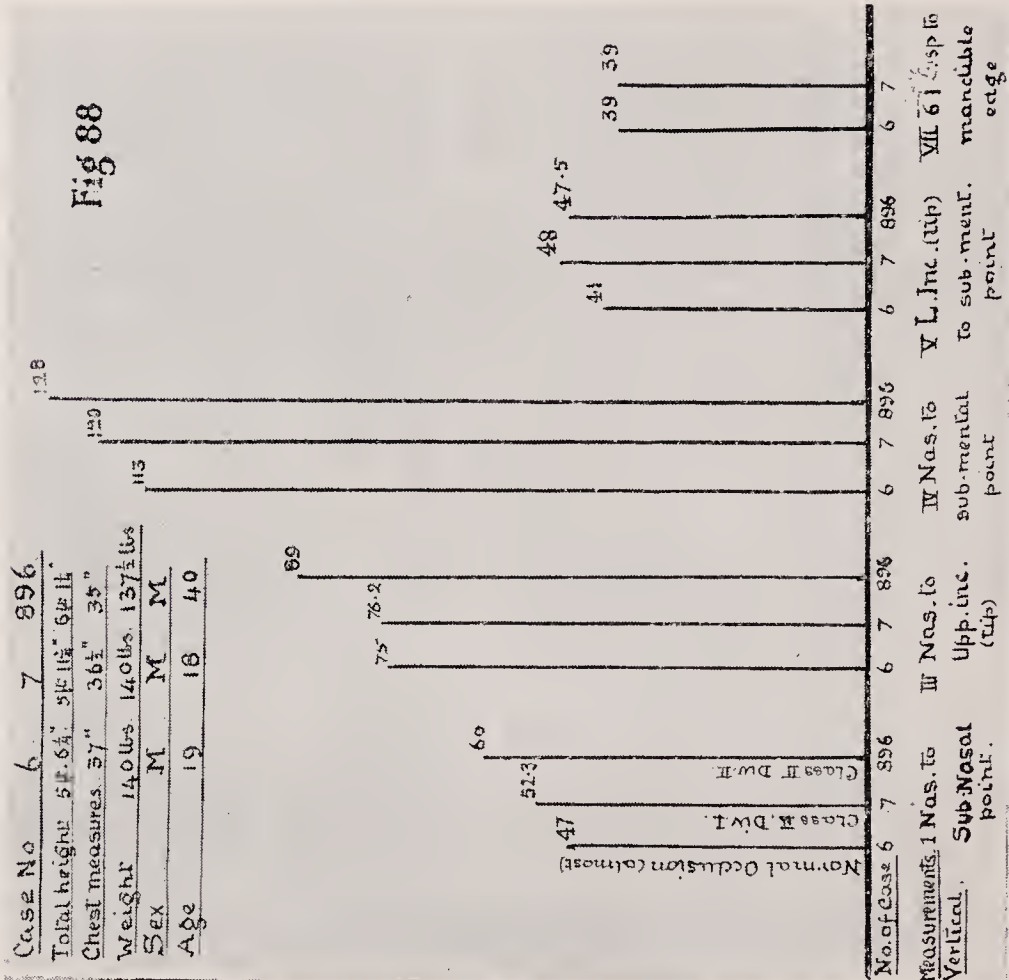


Fig. 87. Table comparing Cases 6, 7, 896 and Campion's means.
Fig. 88. Comparing cases, vertical measurements.
Fig. 89. Comparing cases, lateral measurements.



Figs. 90, 91, 92, and 93. Case No. 720, Class II, Division I.
 Figs. 94, 95, 96, 97 and 98. Case No. 859, Class I. (slight).



Figs. 99 to 103. Case No. 862. Normal occlusion.
Fig. 104. Cases Nos. 720, 859 and 862.

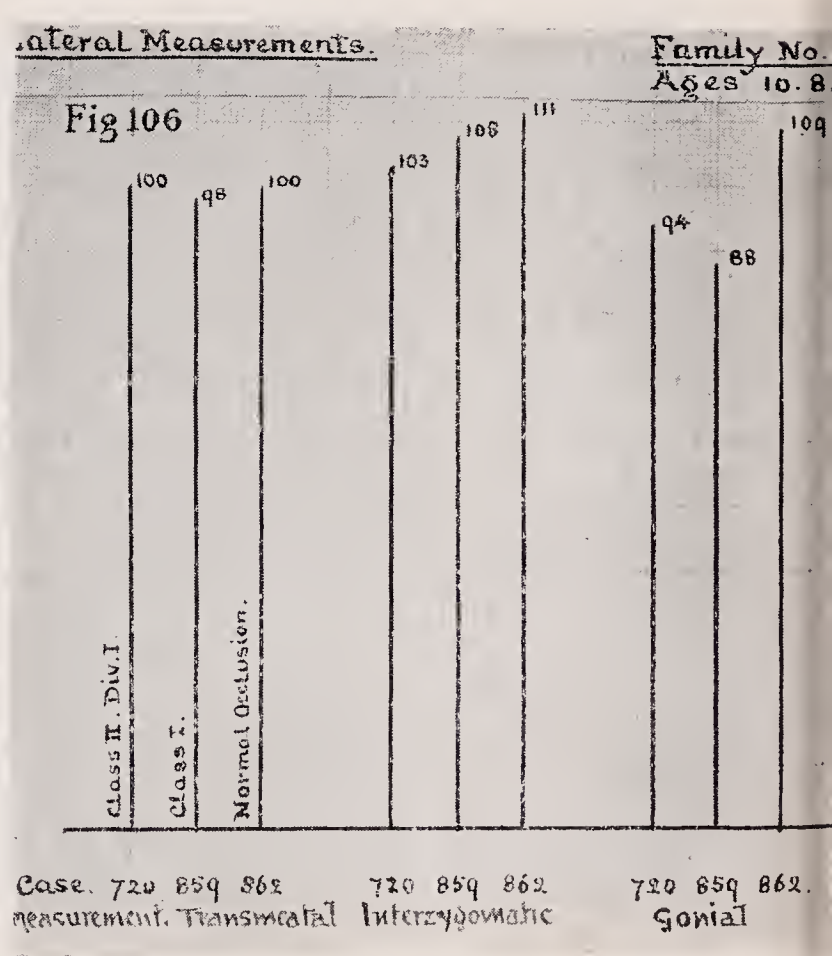
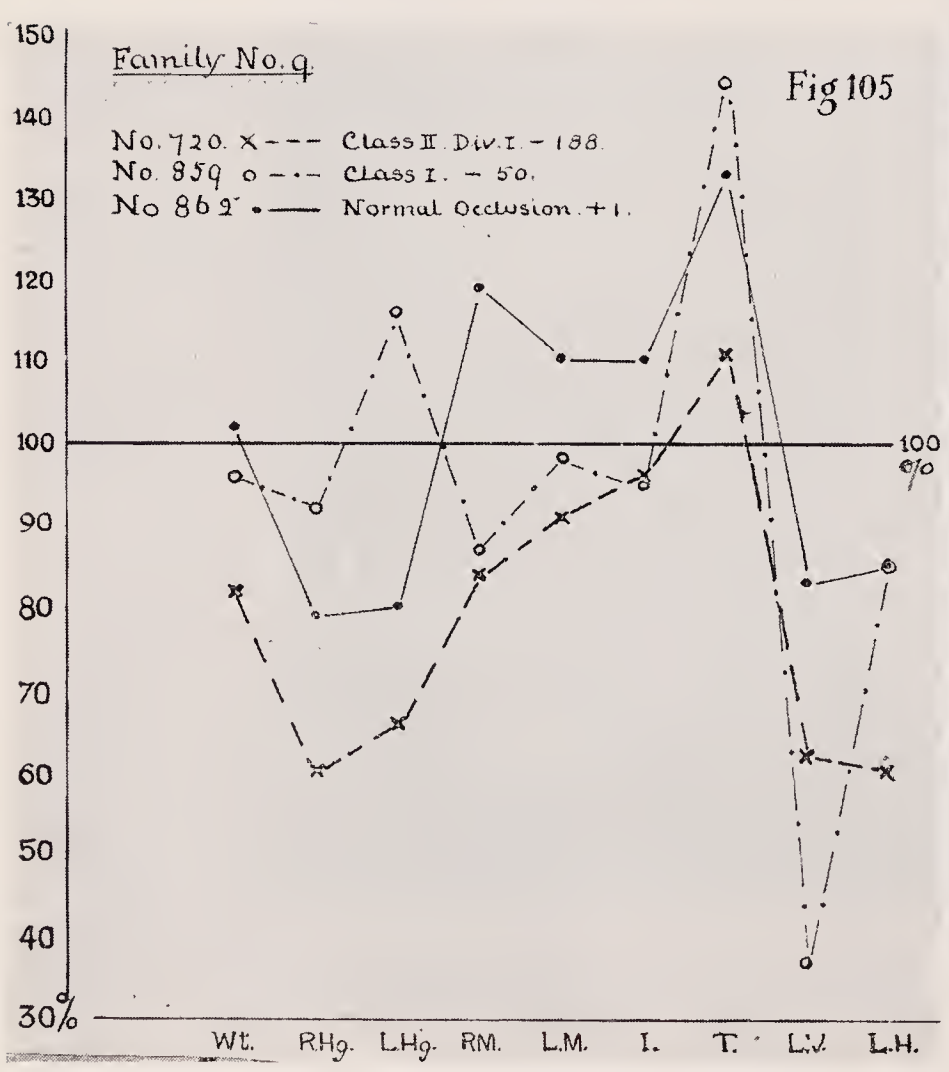


Fig. 105. Showing result of physical tests family No. 9. The best results are obtained from the normal occlusion girl; the Class I. girl

better than the post-normal girl; the two latter were under some orthodontic treatment.

Fig. 106. Lateral facial measurements.

Physical Tests.

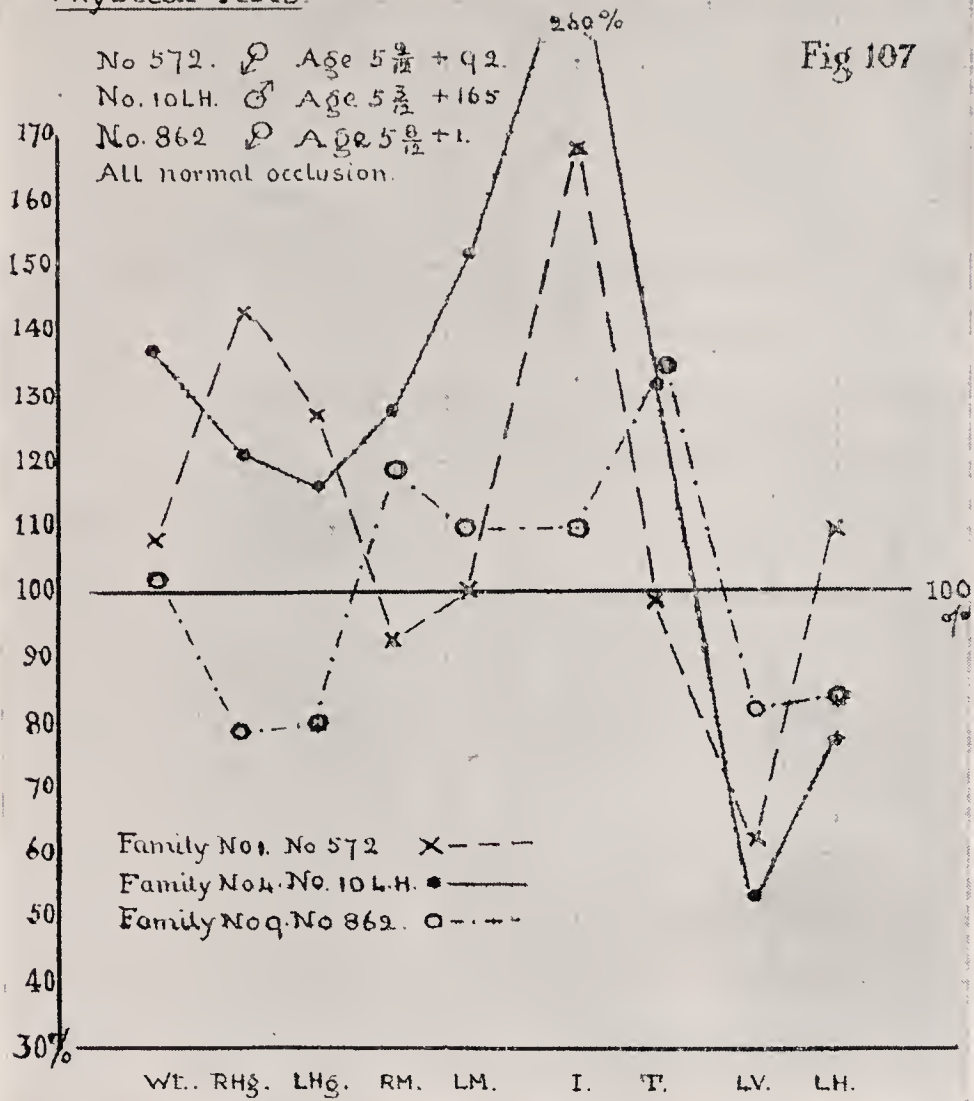


Fig. 107. Comparing the results of physical tests of cases Nos. 572, 10 L.H. and 862, all normal occlusion and a difference in age not exceeding 6 months.

Lateral Measurements.

Fig 108

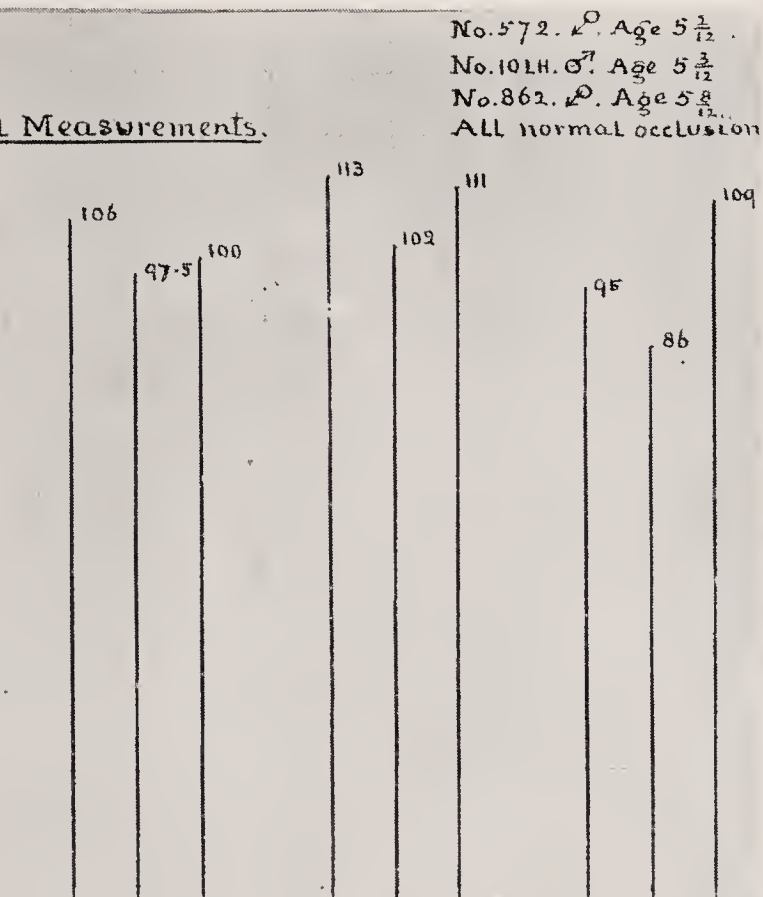
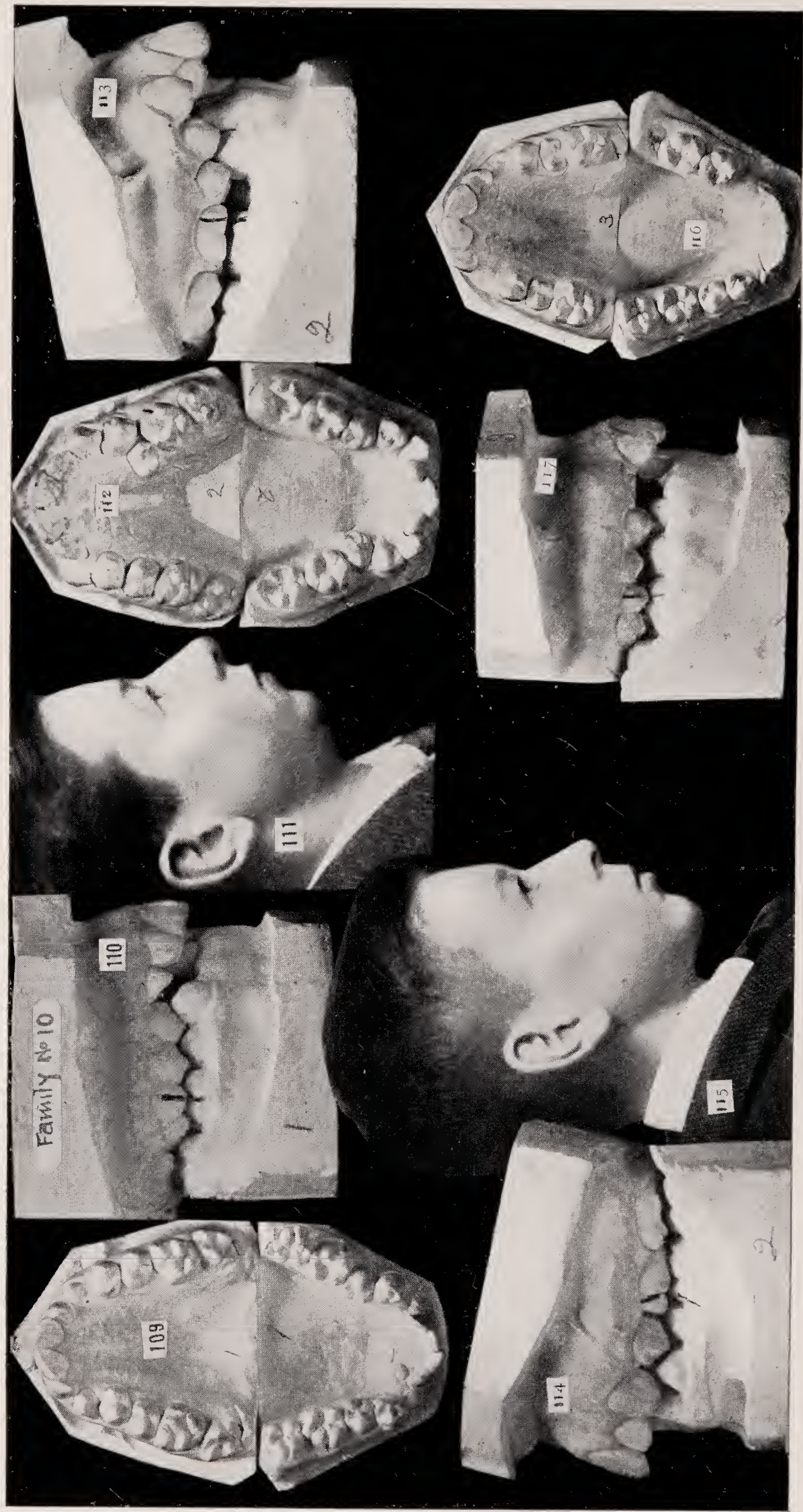


Fig. 108. Comparing lateral facial measurements of Cases 572, 10 L.H. and 862.

No. of Case	572	10 L.H.	862	572	10 L.H.	862	572	10 L.H.	862
Measurements.	Transmeatal			Interzygomatic			Gonial.		
No. of Case.	572.			10 L.H.			862		
Area of Palate.	11.15 sq. cm.			10.46 sq. cm.			10.92 sq. cm.		
Height of Palate.	16 mm			14 mm.			13 mm.		
Inter canine Width	$\frac{c}{c}$ 22.5 mm.			21 mm.			22.6 mm		
	$\frac{c}{c}$ 20. mm			14 mm			19.5 mm		
Inter molar Width.	$\frac{e}{e}$ 27.6 mm.			24.5 mm			27.6 mm		
	$\frac{e}{e}$ 26.3 mm			22. mm			26. mm		



Figs. 109, 110 and 111. Case No. 1 L.H.,
Class I. (severe).

Figs. 112, 113, 114 and 115.
Case No. 2 L.H., Class II, Division I.

Figs. 116, 117 and 118.
Case No. 3 L.H., Class I. (severe).



Figs. 119 and 120 Cases 1 L.H., 2 L.H. and 3 L.H

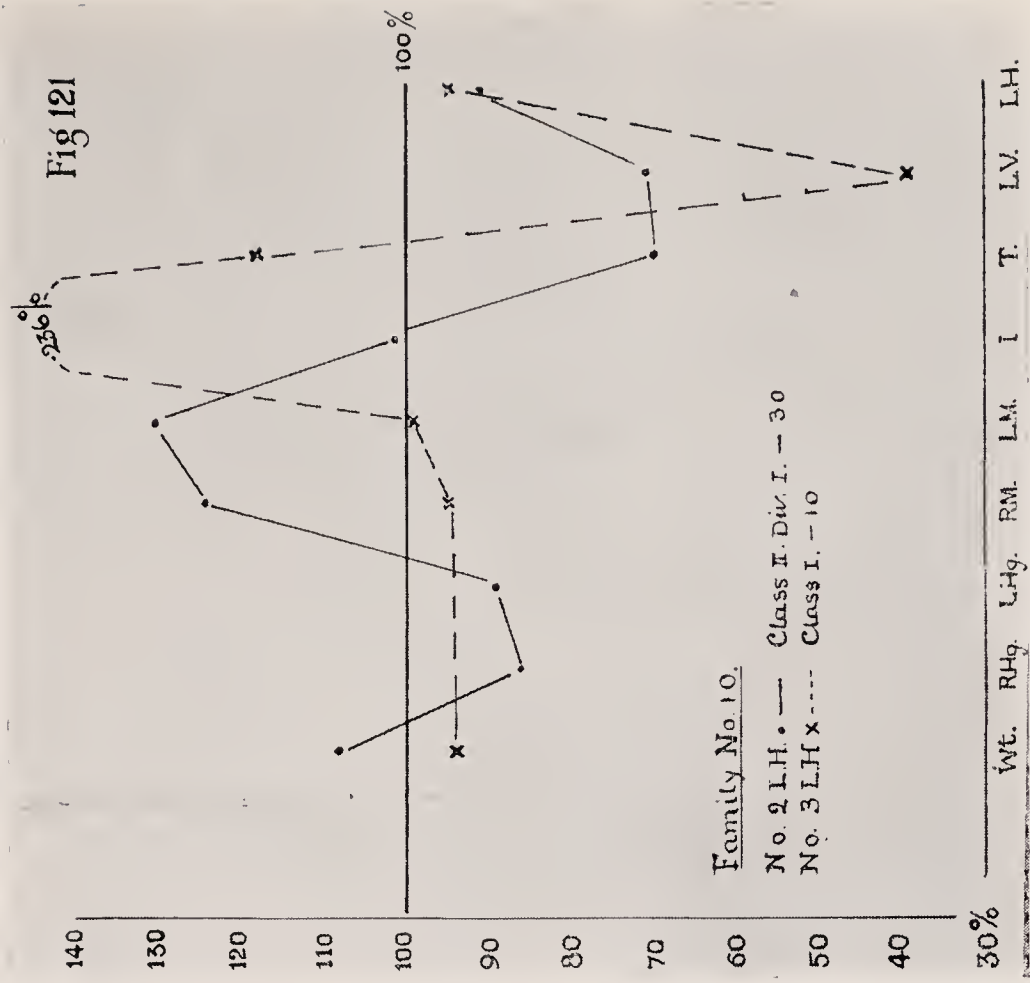


Fig. 121. Showing the results of physical tests in family No. 10. Cases 2 L.H. and 3 L.H. No. 3 was under orthodontic treatment; nevertheless the results are better than in the case of her post-normal brother.

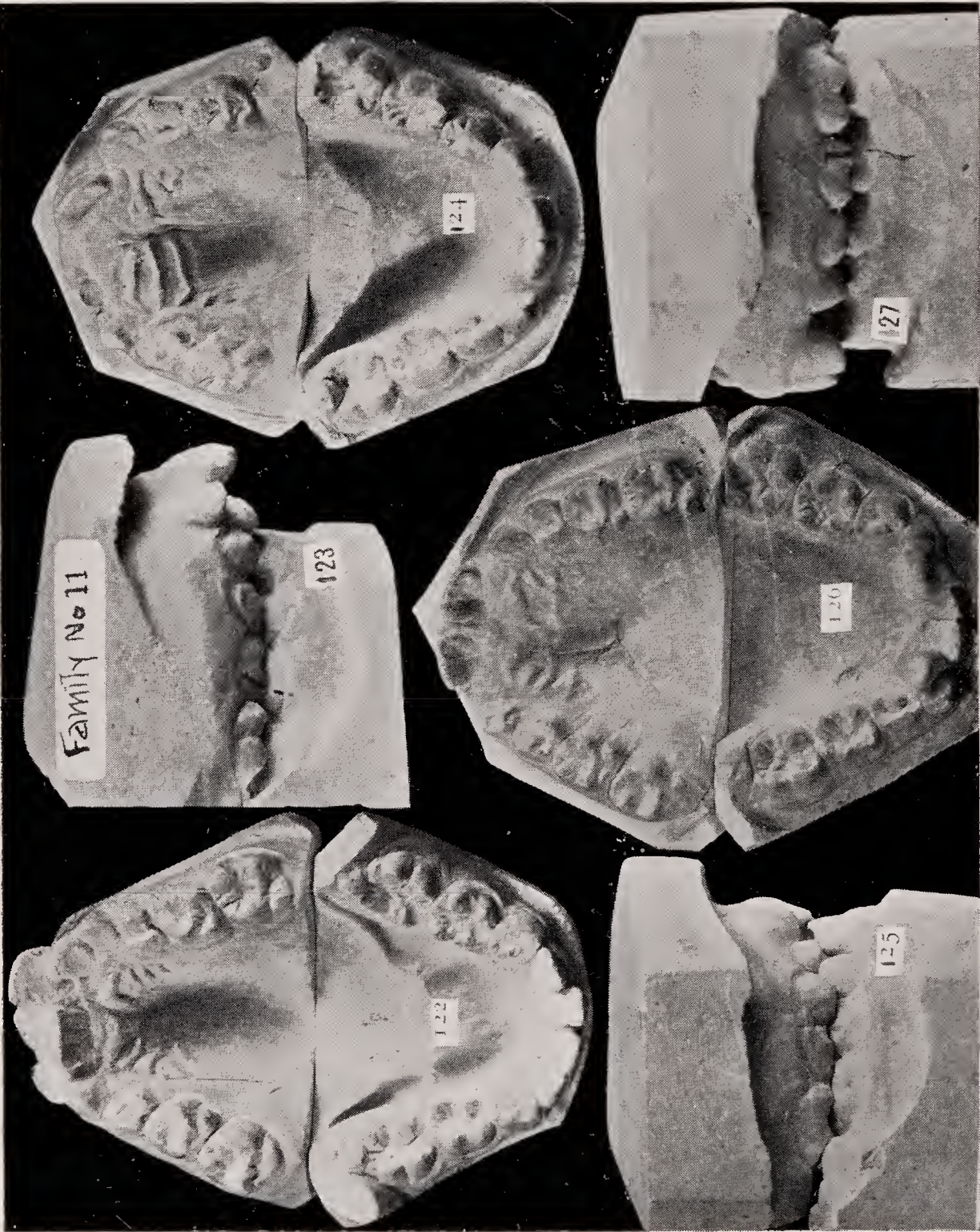
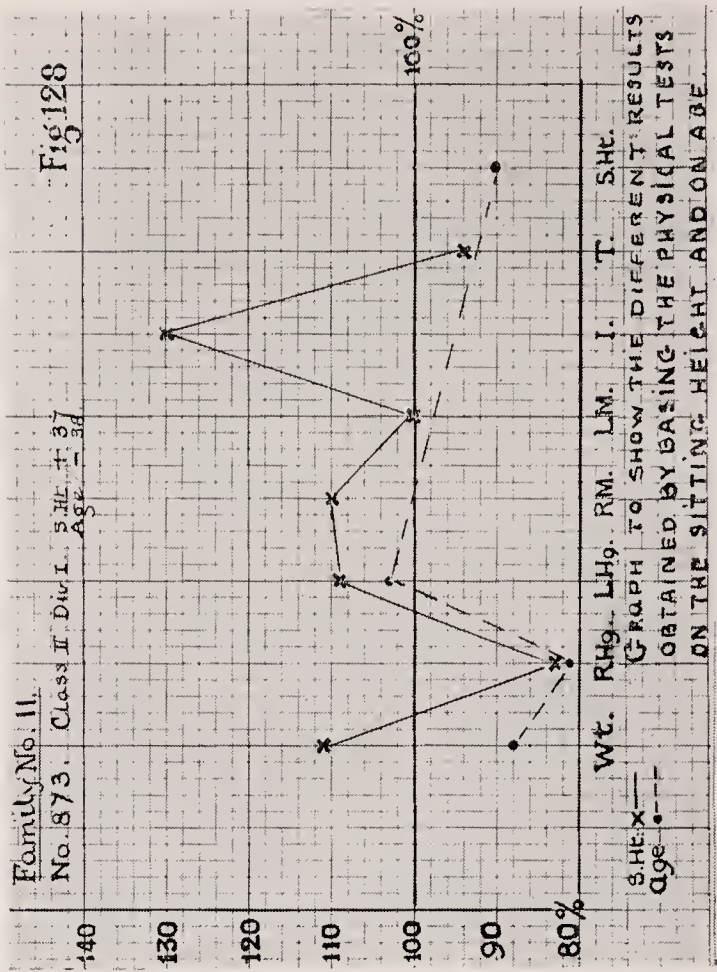


Fig. 128. Showing the different results obtained by basing the physical tests on the sitting height and on age; in under-size children the former gives a better result than the latter.



Figs. 122 and 123. Case No. 384, Class II, Division I.
Figs. 124 and 125. Case No. 400, Class I. (severe).
Figs. 126 and 127. Case No. 873, Class II, Division I



Figs. 129 to 132. Case No. 600, Class II, Division I.
 Figs. 133 and 134 Case No. 626, Class II, Division I.
 Figs. 135 to 137. Case No. 648, Class II, Division I.
 Figs. 138 to 140. Case No. 746, Class II, Division I.

Cases Summarized according to the Occlusion.

NORMAL OCCLUSION. FIVE CASES.

No. of case.	Ante-natal Factors.	Diet 1st year.	Habits.	Mastica- tion.	Tonsils and Adenoids.	Breathing and other factors.	Notes on possible hereditary and occlusal factors.
572	Maternal health good.	Artificial.	Sucked fingers.	Excellent	—	Seriously ill first year.	Father nor- mal occlu- sion. One grand- father excellent teeth.
6	Absolutely normal.	Natural.	Comforter 2 years.	Vigorous.	Removed æt. 7.	—	Father Class II. Div. II. Mother probably normal.
870	—	Artificial.	Comforter.	—	Removed. æt. 8.	Slept with mouth open.	
10LH	—	Natural.	—	Good.	—	—	
862	Paternal and mat- ernal health good.	Artificial except first 2 months.	None.	Medium.	—	Very strong.	
Summary of above 5 cases.	Maternal health good 3. No data 2.	Natural 2. Artificial 3.	Comforter 2. Sucked fingers 1. None 2.	Good 4. No data 1.	Tonsils and adenoid removed 2.	—	

CLASS I. (SLIGHT). FOUR CASES.

868	Birth not natural.	Natural. Insuffi- cient.	—	Slow eater.	Removed æt. 12.	Mouth breather from 4 years. Slept with mouth open.	1 brother. Class II. Div. I. 1 brother normal.
736	—	Artificial.	—	—	—	—	
898	Natural.	Natural 7 months.	Comforter.	Medium.	—	Mouth breather, probably rickety.	
859	Mother ill after birth.	Natural 3 months.	Bad thumb sucker.	Medium.	—	Nose breather. Under weight. till æt. 7	
Summary of above 4 cases.	Good 1. Doubtful 2. No data 1.	Natural 1. Mixed 2. Artificial 1.	Comforter 1 Sucked thumb 1. No data 2.	Medium 3. No data 1.	Tonsils and adenoids removed 1. None 1. No data 2.	Mouth breathers 2 Nose breather 1. No data 1.	

Cases Summarized according to the Occlusion—continued.

CLASS I (SEVERE). FOUR CASES.

No. of case.	Ante-natal Factors.	Diet 1st year.	Habits.	Mastica- tion.	Tonsils and adenoids.	Breathing and other factors.	Notes on possible hereditary and occlusal factors.
660	—	Artificial.	Sucked lips and sheets.	Very poor.	—	Nose breather.	
1 LH	—	Natural, supple- mented by arti- ficial.	—	Rather swift.	No trouble.	Nose	Very similar arches. cf. 2 LH in Class II. Div. I.
3 LH	—	Natural, supple- mented by arti- ficial.	Sucked two fingers.	Slow.	No trouble.	Nose.	
400	Mother lived in Petrograd till 6 weeks before birth.	Natural 4 months.	—	Did not masticate at all till æt. 3½.	—	Tuber- cular glands, etc.	Father Class II. Div. II. Mother probably Class II. Div. I.
Summary of above 4 cases.	Doubtful 1. No data 3.	Mixed 3. Artificial 1.	Sucked lips 1. Sucked fingers 1. No data 2.	Medium 2. Poor 1. Bad 1.	No trouble 2. No data 2.	Nose breathers 3. No data 1.	

Cases Summarized according to the Occlusion—*continued.*

Class II. Div. I.—14 Cases.

No. of case.	Ante-natal factors.	Diet 1st year.	Habits.	Mastication.	Tonsils and Adenoids.	Breathing and other factors.	Notes on possible hereditary and occlusal factors.
860.	Mother nervous in air raids. Nursed the father with pleurisy.	—	Sucked 2 or 3 fingers till <i>æt.</i> 8 6/12.	—	—	—	Occlusion similar to father's.
7.	Born end of sixth month.	Natural 3 months.	None.	Poor—fast.	Removed as soon as recognised	Never serious mouth breather.	Father Class II. Div. II. Mother probably Class I.
5LH.	Born 13 months after sister. Mother worked 8 months before child was born.	Natural.	—	Good but faddy.	—	Probably mouth breather.	
869	—	Artificial.	Comforter 1-3 years.	Tends to bolt.	Removed <i>æt.</i> 8.	Probably mouth breather.	Father probably Class I. open bite.
4LH	—	Natural 6 weeks.	Sucked thumb, started at 3 months.	Good.	—	Always slept with mouth open.	
333	Normal.	Natural.	None.	Medium.	—	—	Father Class II. Div. II. but very good. Mother Class II. Div. I.
720	Mother ill. Induced 2 weeks before term.	Natural 5 months.	Sucked thumb.	Medium.	Adenoids removed <i>æt.</i> 10.	Nose.	
2LH	—	Natural.	—	—	Removed <i>æt.</i> 9.	—	Arches very similar to brother and sister, 1L.H. and 3L.H. (<i>vide</i> Class I.)
384	Mother in Petrograd till 6 weeks before birth.	Natural 6 months.	Bit nails till <i>æt.</i> 10.	—	Removed <i>æt.</i> 12.	Weight at birth 6¾ lbs. Probably delicate.	Father Class II. Div. II. Mother Class II. Div. I.
873	Mother travelled from Petrograd 2 months before. Probably no effect.	Natural 4 months.	—	—	Removed <i>æt.</i> 6 8/12.	Weight at birth 5 lbs. 7 ozs. Very thin baby.	Father Class II. Div. II. Mother Class II. Div. I.

Cases Summarized according to the Occlusion—continued.

Class II, Div. I.—14 Cases—continued.

No. of case.	Ante-natal factors.	Diet 1st year.	Habits.	Mastication.	Tonsils and Adenoids.	Breathing and other factors.	Notes on possible hereditary and occlusal factors.
600	Mother's health excellent <i>æt</i> 21. Child very strong and healthy.	Natural 3 weeks.	None.	Good. Appetite good.	—	Nose breather.	Mother Class II. Div. I. The next 3 cases. 626, 648, 746 are sisters of this one.
626	Mother attack of gall-stones. Husband torpedoed.	Artificial. Child healthy. Appetite bad.	None.	Appetite bad.	Adenoids removed <i>æt.</i> 4. Tonsils removed <i>æt.</i> 6.	Through mouth till adenoids removed.	
648	Health very good in spite of war. Child very healthy.	Artificial.	None.	Good.	—	Nose breather.	
746	Health good, but more discomfort than with 600, 626, 648.	Artificial.	Thumb sucked at 18 months till <i>æt.</i> 4.	Good.	—	Nose in day. Mouth at night.	
Summary of above 14 cases.	Good 4. Bad 4. Doubtful 3. No data 3.	Natural 3. Mixed 6. Artificial 4. No data 1.	Sucking habits 4. Comforter 1. None 6. No data 3.	Good 5. Medium 3. Poor 2. No data 4.	Tonsils and Adenoids removed 6. Adenoids only removed 1. None 6. No data 1.	Nose breathers 4. Mouth breathers 5. No data 5.	4 of these cases in one family 2 of these cases in one other family. <i>Vide</i> notes above.

CLASS II. DIV. II. TWO CASES.

737.	—	Natural.	—	—	—	—	—
865.	—	Artificial.	Sucked lips, etc.	Very feeble.		Nose breather.	—

Summary of the Results of the Physical Tests.

The superiority of the normal occlusion cases over the others is well marked. The figures are the sum of the difference between the percentages below 100 per cent. and 100 per cent. subtracted from the sum of the difference between 100 per cent. and the percentages over 100 per cent. (reckoning 150 per cent. or more as 150 per cent.).

No. of Case. The numbers of the cases are given in the order in which they occur in the cols.	Occlusion Normal.		Class I.		Class II. Div. I.	
	+	—	+	—	+	—
Family No. 1. No. 572	+ 92					
Family No. 2. Nos. 870, 868 and 869 ...	+ 198		+ 93 (slight)		+ 110	
Family No. 4. Nos. 10 L.H. 5 L.H., 4 L.H. ...	+ 165				+ 171*	— 15
Family No. 7. Nos. 6, 7	+ 206				+ 90	
Family No. 8. Nos. 898, 333			+ 50 (slight)		+ 112†	
Family No. 9. Nos. 862, 859, 720	+ 1 ‡			— 50		— 188
Family No. 10. Nos. 3 L.H., 2 L.H.				— 10		— 30
Average	+ 132.4		+ 20.75		+ 35.71	

* No. 5 L.H. (+ 171). The incisor occlusions gave this boy much advantage over his sister.

† No. 333 (+ 112). A stronger boy physically than his brother, No. 898 (+ 50), who is Class I, but probably rickety.

‡ No. 862 (+ 1). It is doubtful if this child exerted her maximum strength,

A CASE OF EXPANSION OF A NARROW ARCH IN A CLEFT PALATE.

By J. KENNETH GRAYSON, L.D.S.

I MUST apologise for bringing forward an unfinished case, but it is Mr. Packham's fault in calling on me, a rather junior member, for a communication. The history of the case, as far as I can gather from the patient's mother, is that the cleft originally involved the whole of the soft palate and about two-thirds of the hard palate, and for this she had three operations. The first at two years of age on the hard palate, was completely successful. The other two operations were on the soft palate, and both subsequently failed. The patient was first seen by Mr. Maxwell Stephens at $9\frac{1}{2}$ years of age, and the condition was then as shown in the first slide. Two of the first permanent molars were carious, but it was decided to keep those two to prop the bite, as the deciduous teeth were all about to be lost, and try and expand the arches. She started treatment with Mr. White for her speech as soon as the obturator was made. The lower jaw was expanded with the usual type of Badcock expansion screw plate with finger springs on the molars. The upper plate was made in two stages. An ordinary model was taken of the hard palate and a vulcanite plate made to this with the various springs already in position. This was then fitted in the mouth and soft composition moulded in position to fill the cleft in the soft palate without causing any displacement of the surrounding soft tissue. A soft rubber obturator, shaped like a small tea-scoop, was then vulcanised on to the first plate from this model. The wires on the upper plate at first consisted of full Jackson cribs over the molars with long finger springs attached mesially pressing the erupted molars outwards.

A further upper plate was then made in which the full cribs were placed around the premolars and the finger springs moved backwards to press the molars outwards and a small biting plane placed in the incisor region. The position is shown in the third slide. During this time the finger springs on the lower plate were adjusted to move the lower molars outwards. The start of the eruption of the upper right canine made a complication, but as the movement of the teeth and the arch had developed so well and her phonation had improved so markedly, it was decided to try and draw the incisors forward. This was attempted with finger springs on both plates and the canine is now coming into position. The treatment of the case has been carried out with great caution, and consequently has spread itself over a long period. The two molars have been carried on with cement fillings renewed from time to time. Only two other cavities, one in an upper premolar and the other in a lower incisor, have occurred, in spite of the appliance having been worn for so long.

DISCUSSION.

Mr. SCHELLING asked the age of the patient at the present time.

Mr. GRAYSON said she was 14.

The PRESIDENT said the communication was a very interesting one, and the case showed an extremely good result. A matter of special

interest was that Mr. Grayson had used small finger springs, which rather emphasised the point that perhaps orthodontists were apt to overlook from time to time, the fact that the attachments they used with fixed appliances could also be used with removable ones, and *vice versa*. If that was remembered practitioners might probably make things a little easier for themselves.

Mr. A. T. PITTS said that such cases as had been presented took a long time, and he appreciated the extremely fine results Mr. Grayson had obtained, and he congratulated him upon the case. An interesting feature was that Mr. Grayson had combined the orthodontic appliance with an obturator, which was a very good idea, although one would imagine it made the stability of the plate when in the mouth a little more difficult.

Mr. MAXWELL STEPHENS said when the child was first seen there was a very poor occlusion, and the child was not developing at all well, and that decided him to expand the arch to get occlusion. Undoubtedly the child's health did improve when that was carried out. It led to a great deal of inclination of the teeth; there was not the same amount of translation, the teeth being very much inclined in their sockets.

NATURAL LABIAL MOVEMENT OF LOWER INCISORS.

By G. NORTHCROFT, L.D.S.

TRIVIAL as this communication may seem, it emphasises a broad principle, and illustrates how we should await natural development before jumping to conclusions.

The first models are those of a female aged 5 years 5 months, and show the permanent lower incisors erupting in a very posterior position. Their forward movement, five months later, probably indicates the force of tongue pressure, and shows how easily erupting teeth are guided into their correct positions before the large open mouths of the crypts are closed by the growth of alveolar bone.

Note the early eruption of these teeth at 5 years 5 months, and also the presence of the 6 which, erupting for six months without an opponent, has already been extruded beyond its proper level. Once more the necessity is shown of accumulating data from many sources in order to properly study the typical and atypical lines of growth, and thereby arrive at a true conception of the hypothetical ideal.

DISCUSSION.

The PRESIDENT said Mr. Northcroft's case was interesting from two points of view he had referred to, the forward movement of the teeth and the over-eruption of an upper permanent pre-molar. It would be very interesting if Mr. Northcroft would report the case again later, so that it could be seen whether the molar was on a lower level than the rest of the teeth. He himself had seen recently a case of a similar nature. He saw the child six or eight weeks ago, and was not sure whether she had lost her deciduous central then or not, but the next time the child came the upper permanent central had erupted lingually, and there was no suspicion at the previous visit that that would happen. Such things took place very rapidly, and the patient could not always be caught at the psychological moment to see what was happening.

Mr. WARWICK JAMES said that when he was working with Mr. Pitts they found that the actual gum of the molar was in occlusion prior

CASE OF EXPANSION OF A NARROW ARCH IN A CLEFT PALATE.

BY J. KENNETH GRAYSON, L.D.S.

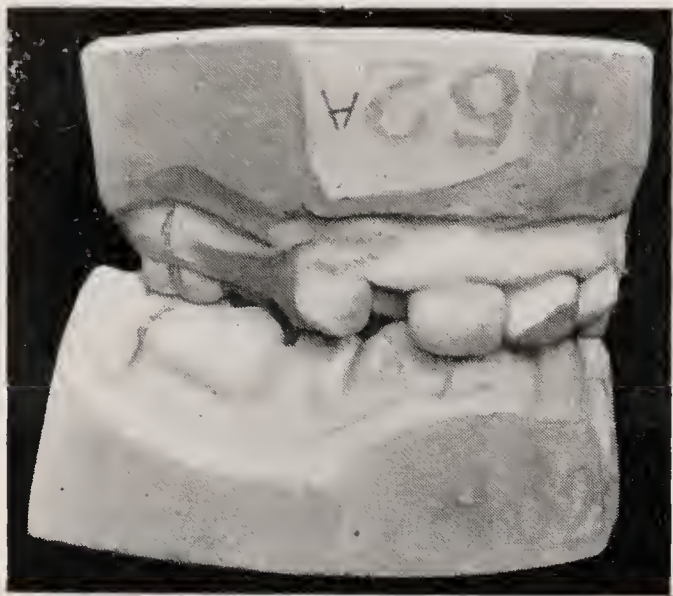


Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.

CASE OF EXPANSION OF A NARROW ARCH IN A CLEFT PALATE.



Fig. 5.

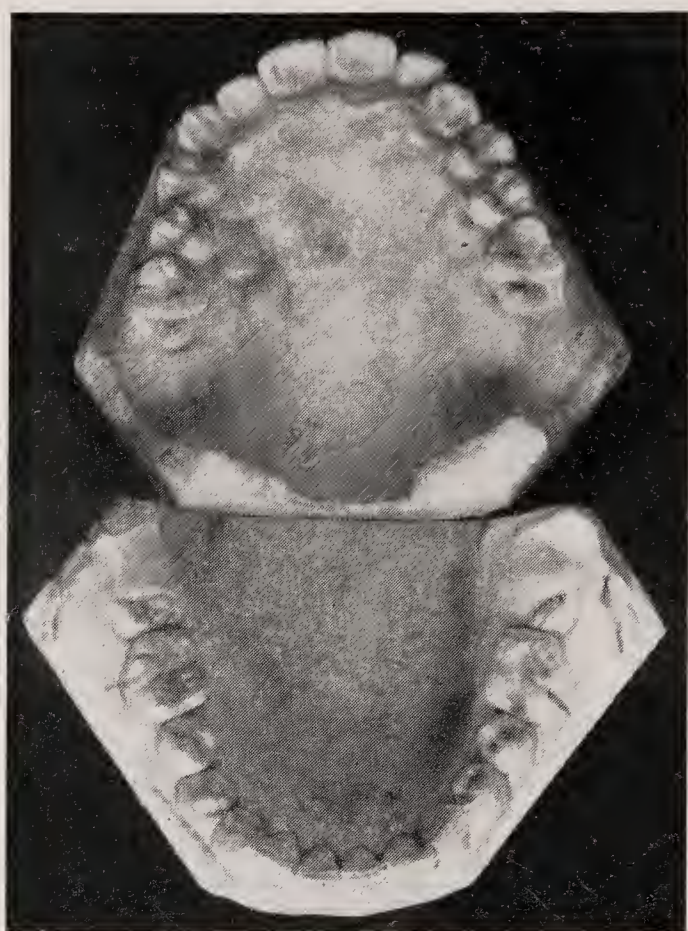


Fig. 6.

NATURAL LABIAL MOVEMENT OF LOWER INCISORS.

BY G. NORTHCROFT, L.D.S.



to the eruption of the first permanent molars in the majority of cases, and that the exposure of the tooth was largely due to the uncovering tissue rather than the actual extrusion of the tooth. He was wondering whether the models would show the position of the gum to be lower than the first permanent molars.

Mr. NORTHCROFT thought that it could be seen on the models.

Mr. JAMES said the case supported the contention that apparently the tissues grew around the tooth and the gum was moved from and over the tooth in the majority of cases. The gums were often in occlusion at the very beginning.

Mr. CALE MATTHEWS thought the point of the rapid eruption of unimpeded teeth should be given very much more thought than was customary. Teeth erupted at a greater rate than many people were conscious of. With regard to Mr. Warwick James's point as to the contact of the gum, it must be within the experience of all the members that if they took a composition impression of erupting sixes, when the sixes were practically erupting it was very often difficult to occlude them, and it was necessary to pare away the posterior part of the model owing to the gum not having gone away sufficiently to occlude the models properly. That showed that the gum over the erupting first molars was in contact on many occasions.

Mr. NORMAN BENNETT said it seemed to him it was not only in contact but was actually compressed every time the child was biting.

Mr. TUDOR said that in cases where there appeared to be no spacing of the temporary teeth at all, either in the upper jaw or the lower, and the two central upper incisors were erupting, there was no room for them to be pushed forward by the tongue, and he should like Mr. Northcroft to say whether he thought the correct procedure was to remove the two lower temporary laterals in order to allow the two permanent centrals to come forward.

Mr. H. E. MARSH said the case brought to mind one of the greatest problems in orthodontics, the question of whether orthodontists should interfere or not, at the age of the beginning of eruption through the gum, of the lower central incisors. To his mind the peculiar condition of the case was the fairly decent spacing in the upper jaw. It was necessary to take into consideration a great many facts at that age before deciding to interfere. It was important to interfere at the right moment, because it was possible to conceive a good deal of serious after-effects by not doing so at the right time, if interference was really needed. It was necessary to bear in mind the size of the tongue and the general development of both jaws and the spacing and the child's maxilla condition altogether. It would be a very great advantage if on some occasion something could be formulated in the shape of conditions which would indicate the desirability of treatment of such cases. It was always a great problem whether to wait and see what was going to happen or to commence the work.

Mr. NORTHCROFT said the point which had been brought up about the lower incisors was the surprising fact, although it sounded almost impossible, that when the lower permanent incisors had moved forward into the arch in the space of four or five months the space was exactly the same. There was not a millimetre difference between the mesial surfaces of the temporary incisors before and after. He should have thought that Nature would have expanded the lower jaw as well, but on measuring it he found a space exactly the same.

CASUAL COMMUNICATIONS OF MEMBERS.

Mr. L. F. FOURAKER demonstrated the following devices—

A Simple Attachment to a Plain Band for Supporting the Arch.

(Modification of Dr. E. O. Busby's method.)

The principle employed is the same as that used to lock in the lingual

arch with a soft wire. A plain band is made with a flat overlap joint buccally, or a lingual point.

A piece of band material about one-third of the total buccal surface of the band is now soldered to the band in the region where the lock wire is desired,* so as to extend from the cervical to the incisal edge of the band.

A soft round lock wire, such as Nox. C or iridio platinum, gauge 20 or 22 (half round wire may also be used—it will allow the tooth less “play”), is now attached to the section of band material on the band near its incisal edge with a slight inclination cervically. The lock wire is cut off, leaving as much as will enable the arch to be grasped by it, and its other end reach to the cervical edge of the band, after engaging the arch. The lock wire is given a bend (which will accommodate the arch) near its attachment and finished off for cementation to the tooth. The arch is placed in position and the free end of the lock wire bent over to the occlusal margin of the band grasping the arch securely.

This lock wire may be opened and closed a large number of times without breakage; leverage with a flat instrument, such as a spatula, will open the loop; it may be closed with a band adapter. If the lock wire is attached to the arch and a loop, to be engaged by the lock wire, soldered on the band the same principle is made use of and repair of the lock wire can be accomplished without removal of the band; this method has not been tried in practice.

An Attachment to Prevent Up and Down Movement of the Lingual Arch.

The lingual arch may be secured from up and down movement by attaching to the band a loop of wire (platinised gold or lock wire) soldered to the band at both ends. The loop is of such a size and placed in such a direction that the arch will lie on its gingival aspect, and in gentle contact with it. If there is pressure on this loop the tooth is liable to be elongated.

An Adjustable Attachment for Fixing the Position of the Buccal Arch in Horizontal Tubes.

The buccal arch is fitted in the usual way; about 5 mm. in front of the medial end of the buccal tube a length of gauge 21 wire is soldered at right angles; this is made into a loop, a little smaller than the circumference of a lead pencil, directed backwards; where the loop reaches the arch again it is brought as far as the arch on its buccal aspect and then bent back on itself, but this time on the other aspect of the arch, so that the latter is embraced by it; the wire is cut off immediately beyond the arch and the free end made to more or less grip the arch, if it does not do so already; this can usually be done when the wire is bent back on itself. This end of the wire is made to come in such a position that it will coincide with the medial end of the horizontal tube; but it is adjustable by opening or closing the loop so that pressure palatally may be brought on the incisors, or on them in a forward direction through the medium of bands.

Rotation of a Tooth with an Auxiliary Spring.

A tooth may be rotated by means of an auxiliary spring on a buccal or lingual arch.

Supposing the distal corner of a right upper lateral has to be rotated palatally, a plain band is made for the tooth and a spur, directed medially, soldered to the disto-buccal cervical corner and cut off short, leaving it just long enough to hold a ligature wire.

* (If forward movement only is required the small section of band material should be added in the centre of the band; if rotation is desired it is added towards the corner to be moved buccally; if a rigid attachment is desired the arch should be of flat wire and the lock wire of half round wire).

An auxiliary spring is soldered to the gingival aspect of the lingual arch in the region of the right canine or lateral and extending as far as the right canine; the spring is made to rest palatally to the arch; when the latter is in position a thin ligature wire attaches the spring to the spur on the band; the force applied is regulated by the range of movement given to the spring, which should be pulled up close to the tooth; if the medial corner of the tooth is in a position palatal to that required, the spring will act reciprocally by pressing of the medio-palatal corner.


The spring and the spur must be in the same horizontal plane, or the tooth will be depressed or elongated.

Mr. H. C. HIGHTON demonstrated—

The Construction of the Lingual Arch

together with the various attachments, viz. locks, accessory springs, etc., also buccal arch used in conjunction with same and the attachment of a special lock to the arch.

A Form of Treatment of Post-normal Occlusion.

Mr. WARWICK JAMES demonstrated the procedure he advises in cases where the bite is too close—a method which he has previously shown to the Society. Certain modifications have been made in the procedure, one being the use of pieces of struck gold on a plate, leaving spaces for the premolars to erupt after the bite has been raised; and another, an improvement of the method of advancing the mandible by placing  wire loops in such a manner that the correct position only can be assumed. Mr. James is hoping before long to be able to present the Society with a set of models illustrating the whole method.

Mr. H. E. MARSH demonstrated a—

Lace-wire Bite Plane (Lowe Young's Method)

for the correction of excessive overbite in patients who cannot be persuaded to wear a bite plate. The appliance is "fixed" as far as the patient is concerned, but is quickly removable by the dentist for cleaning and as quickly replaced. Plain bands are fitted to the maxillary central incisors, and to these are soldered vertical wire cleats well toward the distal labial surfaces of the bands and parallel to the long axes of the teeth. Heavy cleats are also soldered to the lingual sides of the bands transverse to the long axes of the teeth.

The maxillary first permanent molars are banded, and half round tubes soldered to their lingual surfaces parallel to the long axes of the teeth. With the four bands in place, an impression is taken, the bands removed and placed in the impression and a cast run. A removable lingual wire is then constructed, its attachment to the half round tubes being by half round rods soldered to the arch and held in by soft lock wire. The lingual arch rests on the transverse cleats on the bands on the centrals. At a short distance back from the anterior portion of this arch is soldered another wire, its ends being joined to the main arch at about the median line of the canines.

In the space between these two wires is fitted a lace wire bent at right angles, so that the angles of the bends reach the wire on either side and are soldered in place, creating an open inclined plane. Gauge of wire used so far .036 in. Close to the gingival end of the labial cleat on each central band is cut a notch. The end of a wire .026 in. gauge, is soldered to the main lingual arch at a point opposite the embrasure between the lateral and central incisors on one side. This is shaped so that it passes down the embrasure between these teeth, and bent labially and then passed up the labial embrasure and turned mesially to enter and pass through the notch in the labial cleat. A loop is bent in the wire which may present incisally or gingivally as desired. This loop should be midway between the labial cleats. The wire is then bent, so that it assumes a similar position between the

central and lateral on the opposite side, and is again soldered to the lingual wire where it encounters it.

If the loop is omitted, great difficulty will be experienced in removing and readjusting the appliance. The object of this wire is to stabilise the front portion of the lingual wire, carrying the bite plane and also to prevent the centrals moving lingually. When the bands are cemented in place and, after that, the arch with bite-plane inserted, it will be found impossible for the patient to get the premolar and molar teeth in contact. As the appliance is worn constantly, in a few months contact is established by the further eruption of the cheek teeth. It must be removed by the operator for cleansing at least once weekly.

A New Form of Retraction Arch.

By Mr. CALE MATTHEWS.

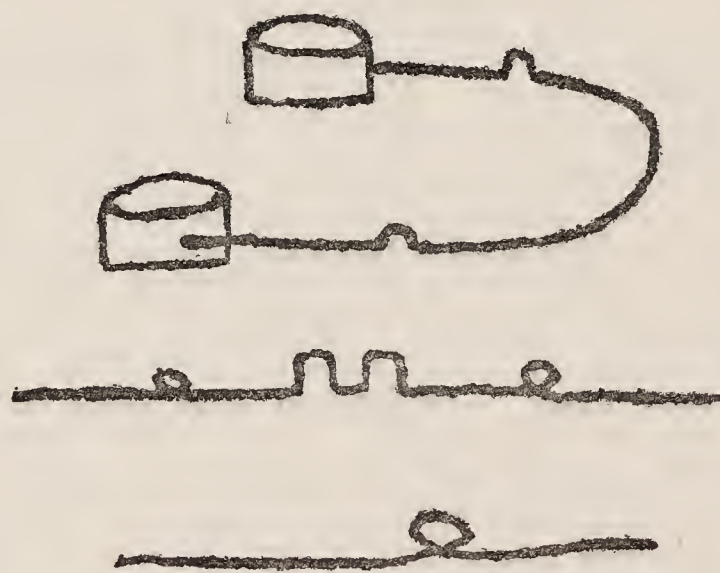
This arose from an emergency, and has since become my routine practice. Use either 19 or 21 gauge platinized gold wire. If used with elastic traction it is necessary that the wire fits the tube on the anchor band. No. 21 slightly used or flattened will pass through an Angle ribbon arch molar band. Take the length of wire and if fitting the arch to the mouth allow the length necessary to fully pass through the tube, then bend a circle which acts as a cleat for the elastic band. If it is desirable to have the arch engaging the incisal edge of the front teeth, a double loop may be taken and the wire continued to conform to the arch and pass into the other molar band tube.

This gives a perfectly rigid delicate retraction—more comfortable and equally as efficient as the larger gauge wires, and is very quickly and easily applied.

Fixed Retraction Arch.

By Mr. CALE MATTHEWS.

Twenty-one gauge platinized gold wire soldered to bands. The loops are closed when necessary without removal. If additional elasticity is desired additional loops are placed, which are not closed. The small gauge wire is hardly noticeable, and the lip is not conscious of it.



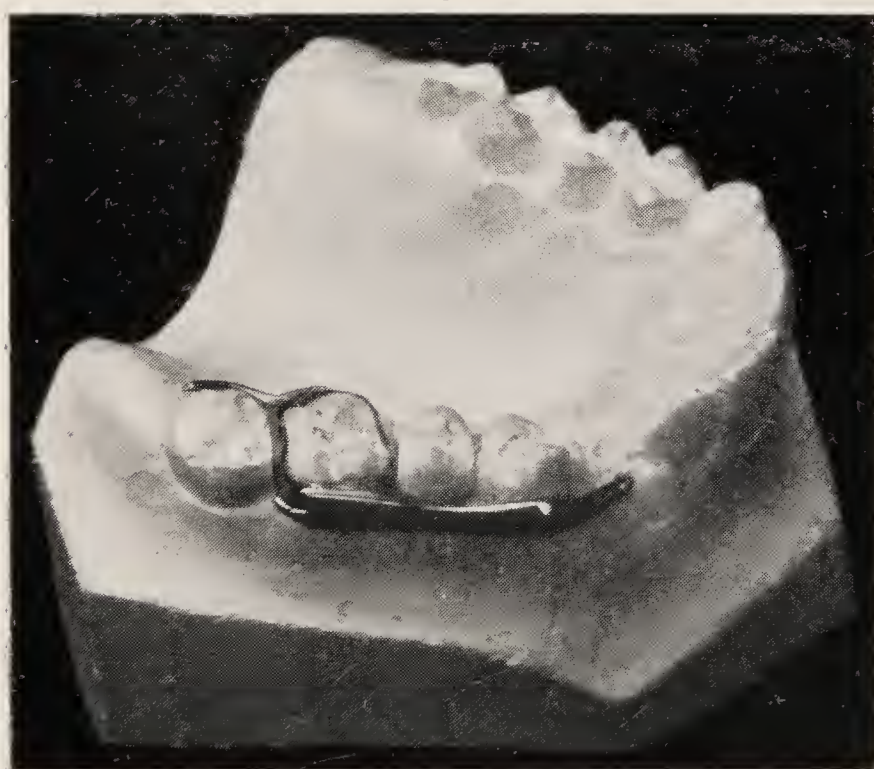
Movement of an Misplaced Canine.

By Mr. GEORGE NORTHCROFT.

The peculiar feature about this case is the eruption of a permanent left upper canine tooth at the age of 38. The temporary predecessor was only lost in May, 1924, and the patient was advised to wait in patience for six months in the hope that the incoming tooth would rapidly improve its position. At the end of that time, however, it was thought desirable to undertake treatment. As it will be seen intermaxillary traction is out of the question, and the apparatus has been designed with a view of :—



Illustrating Mr. CALE MATTHEWS' Casual Communication.



Movement of a misplaced Canine.
Illustrating Mr. G. NORTHCROFT'S Communication.

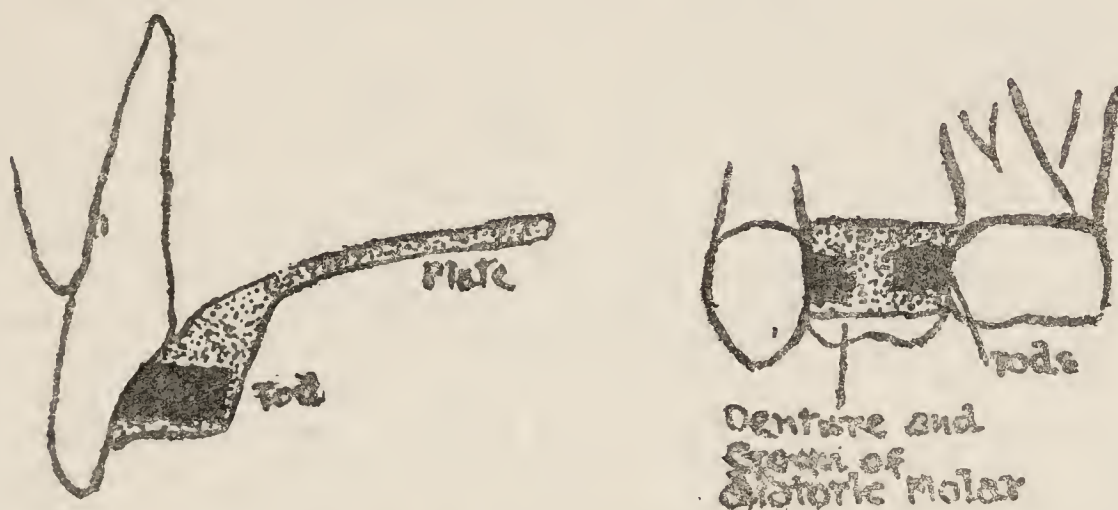
- (1) Satisfactorily grasping the erupting tooth ;
- (2) Obtaining a firm anchorage from which to produce traction ; and
- (3) To render any apparatus worn as inconspicuous as possible for a married woman with many social duties.

Under the gentle elastic traction, which is continuously worn, the canine tooth is being brought backwards, outwards and downwards at a reasonably rapid pace.

A New Form of Plate for "Pegging-out" Teeth.

By WILLIAM OVEY, L.D.S.Eng.

The chief features of this plate will be readily grasped by referring to the diagram. A vulcanite plate is constructed with a substantial block against the tooth to be moved, a non-perforating socket is then drilled to receive a peg cut from a length of $\frac{1}{8}$ in. ebonite rod, which should fit just tightly enough to be removable with fingers or pliers, and trimmed with a file to a comfortable length. If desired a series of pegs may be prepared and given to the patient with instructions to change for the next longer about twice a week. The rod is sold ready turned up by electrical dealers, and can also be obtained in small packets from Messrs. Porro. It is also useful for adjusting the fit of bandless vulcanite dentures, as shown in the second diagram.



Facial Measurements.

By Miss K. C. SMYTH.

Mr. G. G. Champion actually conducted this demonstration, as the measurements and charts are of his devising. They are being used on children in the L.C.C. Schools, under the direction of the Medical Research Council, with the object of obtaining further knowledge as to the growth of the face and jaws. The measurements were carried out at the demonstration on some cases of normal occlusion and some of post-normal occlusion, and the figures obtained were compared with the "norms" which Mr. Champion has prepared in different age groups provisionally. A point of special interest was the application of some of the measurements to Mr. Packham's most unusual case of acromegaly.

Demonstration with Appliances.

By Mr. L. F. FOURAKER, in collaboration with Mr. HAROLD CHAPMAN.

CASE No. 3. DORIS HAMBLING.

CLASS I.—Upper and lower arches too small all round ; overbite excessive.

Appliances.—*Upper* : Badcock plate thickened in front to open the bite and allow the molars to elongate. Visick clasps on $\overline{6}|\underline{6}$. *Lower* : Lingual arch attached by means of half round rods and tubes on bands $\overline{6}|\underline{6}$. The arch is made with three loops ; the expansion is obtained by gradually opening these. (See also Case No. 4.)

CASE NO. 4. DOROTHY ATLEE.

CLASS II, DIV. I.—Upper arch too narrow and too long; lower arch too small all round and in distal relation to the upper; overbite excessive.

Appliances.—*Upper*: Badcock plate, thickened in front to open bite and allow the molars to elongate; the thickened portion is inclined forward to facilitate forward movement of the lower teeth. The looped buccal wire is to reduce the prominence of the upper incisors; the cleats on the latter were to prevent the buccal wire sliding gingivally on the "raked" incisors. The wire extensions to 6 | 6 reduce the amount of vulcanite needed and the interference with function. Visick clasps on e | e. *Lower*: Platinized gold anchor bands on e | e with half round tubes lingually for the attachment of the lingual arch and hooks for intermaxillary traction buccally; a gauge 20 lingual arch (platinized gold) with three loops, which are gradually opened to obtain the expansion of the arch. Soft lock wire (Nox. C gauge 20) is used to prevent displacement of the arch.

A Case of Acromegaly.

By Mr. A. L. PACKHAM.

Male, aged 35. Occupation that of a steward at sea. Patient dates present trouble from July, 1923: two years. First symptoms noticed were weakness and pain in hands and feet, together with general weakness and inability to do work. Became unduly tired after ordinary day's work. After lifting articles hands became swollen and power feeble. A little later noticed lower jaw was becoming more prominent. This slowly progressed, so that he found himself unable to bite with his front teeth as the lower ones came to project beyond the upper. The whole lower jaw is massive and the dental arch is widened, but the teeth are not spaced. The hands are large and the fingers sausage-like. The patient takes number 9 size in boots. Previously he had small feet and took size 6. The right hand and foot are slightly larger than the left. An X-ray photograph of the skull shows the sella turcica to be enlarged to about two and a half times its normal size. The skull and face other than the lower jaw do not appear to be altered. Patient still complains of weakness on any exertion to the extent of his having to abandon his work at sea and to do as little as possible.

AN ordinary meeting of the British Society for the Study of Orthodontics was held at 11, Chandos Street, Cavendish Square, on Monday, May 4th, 1925, at 8 p.m., Mr. HAROLD CHAPMAN (President) in the chair.

PRESENTATION TO MR. HAROLD CHAPMAN.

Mr. S. FRIEL said that before the formal business of the meeting commenced he should like to perform a very pleasurable function. The members of the Society felt that they would like to show their appreciation of what Mr. Harold Chapman had done for the Society during the fourteen years he was Honorary Secretary. When Mr. Chapman took over that office the Society was quite small and its standing was not very high, but when he left it the membership had increased enormously and its standard was second to none in the world as an orthodontic society. The members believed that that was mainly due to Mr. Chapman's efforts. Mr. Chapman had looked after the interest of the Orthodontic Society as he looked after those of his own patients. He had seen that its deciduous teeth were erupted correctly and that its jaws met harmoniously, and he had not left office

until it had completed the eruption of the permanent teeth, except the wisdom teeth, and he was sure that during his year of office Mr. Chapman would see to that matter! He asked Mr. Chapman to accept from the members the small presentation of plate as a token of their esteem.

The presentation consisted of a silver tea service bearing the following inscription :—

“ A token of regard from members of the B.S.S.O. in remembrance of 14 years' unselfish devotion to their interests, 1910-1924.”

The PRESIDENT said that words failed him to say anything in reply either in regard to his own feelings or in regard to what Mr. Friel had said. Mr. Friel had spoken about the Society being small, but the Society, at the time that he took office, had been only in existence three or four years, and it could not be expected to be very large at that time. The words used by Mr. Friel had been unduly laudatory, because he did not think it was so much through his efforts, but largely through the efforts of the members attending the meetings to listen to papers and their interest in the work of the Society. That the growth had occurred whilst he happened to be Secretary was a purely chance affair and he could take no credit for it. Nevertheless, he had to confess that the Society had interested him very deeply, and he had put forth his best efforts to make the meetings as successful as possible. As he had said before, however, those efforts were not his entirely, but were the efforts of the other officers, especially the presidents, and the members. He hoped the Society would progress in the way it had progressed in the past; but he felt Mr. Friel was unduly optimistic in imagining that the Society would cut its wisdom teeth at the age of 17—it was possible, but not probable. When it was 21 or 25 he hoped that interesting event would take place. He could not thank the members sufficiently for the most elegant service of plate they had presented to him. It was the greatest surprise of his life. He felt it was totally undeserved.

Mr. BERNARD A. RILOT signed the roll and was formally admitted a member of the Society.

Mr. J. Stuart Sirey (L.D.S.R.C.S.Edin.), 7, Hillfield Road, West Hampstead, and Mr. C. H. Rubra (L.D.S.R.C.S.Eng.), 66, Crouch Hall Road, London, N.8, were elected members of the Society.

REPORT OF EDUCATION COMMITTEE.

The PRESIDENT said that the Education Committee was called into being again and had been amending the report issued in December, 1922, and Mr. Badcock would present the report to the meeting.

Mr. J. H. BADCOCK said he would formally present the report of the Committee, which he hoped would be printed and in the hands of the members within a short time. The Committee had met frequently and had devoted a great deal of time and attention to the report, and had entirely re-written the appendix and had also reconsidered the references, adding some and deleting some, and in addition had added an extra appendix connected with suggestions for case taking. It was impossible for members to realise the contents of the full report until they had had it in their hands, and therefore he confined himself formally to presenting it.

The PRESIDENT thanked Mr. Badcock, not only for presenting the report, but for the work he had done as chairman of the Committee. Without Mr. Badcock's help he felt the report would not have been half as satisfactory as the members would now consider it to be.

The PRESIDENT said the report would be circulated with the questionnaire of the Investigation Committee. He hoped every member would consider the questionnaire very carefully and help in the collection of statistics on the various points mentioned.

BRITISH DENTAL ASSOCIATION MUSEUM.

The PRESIDENT said he had been asked to announce with regard to the museum at the annual meeting of the British Dental Association that there were two sections, orthodontics and radiology, and they particularly requested those members of the Society who had material exemplifying the sections to loan it to the museum.

AN ordinary general meeting was held at 28, Portland Place, W., on June 16th, 1925, Mr. HAROLD CHAPMAN (President), in the chair.

The PRESIDENT said that it was his pleasure to introduce Dr. John V. Mershon, of Philadelphia, to whom the Society was specially indebted for coming to lecture that evening at the very outset of his vacation. Dr. Mershon had landed only the previous day, and it was a very great compliment to the Society that he should have spent his first day in England preparing the slides and other matter for his lecture—

“A PRACTICAL TALK ON WHY THE LINGUAL ARCH IS APPLICABLE TO THE ORTHODONTIC PROBLEM.”*

The paper concluded with the exhibition of a number of lantern slides by means of which Dr. Mershon explained his methods with greater particularity.

DISCUSSION.

The PRESIDENT said that the Society had listened to a most excellent paper. It was one of the most absorbing papers read before it for many a long day. The point that had struck him was the candour with which Dr. Mershon had told them a great many things which they wanted to hear.

Mr. GEORGE NORTHCROFT said that it had seldom been his privilege to enjoy a discourse on orthodontics so much. As the President had said, it was a paper remarkable for its candour, its freedom from prejudice, and although some of the ideas it advanced might seem revolutionary, he thought they all pointed in the right direction. Those who were admirers of the work of Le Roy Johnson and of Hellman appreciated very much this endeavour to put Orthodontics on a true biological basis, and to do away with so much of the pernicious teaching of the past which had claimed absolute perfection of results if certain dogmatic rules were applied to every case. He thought they would all agree that this had led to many failures in the past, and it was a great pleasure to British Orthodontists to know that their cousins across the water were thinking so broadly and so wisely along these advanced lines. He (the speaker) had always been extremely interested in the study of development and growth, and certainly the orthodontic problem had to be thought of as one of development and growth. Further, it had to be remembered, as Dr. Mershon had pointed out, that every individual reacted differently, and that practically every individual had a different environment, meaning by that word the general make-up of inherited tendencies and growth-factors that affected the individual. In the past the speaker had been an exponent of early treatment, and he was rather perplexed at first to hear Dr. Mershon so roundly abuse the early treatment of the deciduous dentition, but he was much comforted towards the end of the paper when he showed his slides on the screen to find that he (the speaker) had not been so far wrong after all, because the type of cases which Dr. Mershon had shown as having himself

* The paper is not available for publication at the present time, but the discussion, which we publish, brings out many of the points which Dr. Mershon dealt with in his address.

treated were the type which the speaker had also treated and had believed in treating. He had been a little afraid that Dr. Mershon was condemning the treatment of deciduous teeth entirely; he would have been sorry had that been so. One point which surprised him was his condemnation of the closing of the space which sometimes occurred between the permanent central incisors. He thought there were certain cases in which one did good by closing the space, only one had to use very careful judgment in distinguishing between the type of case which should be left alone and the type which should be treated. He had nothing but admiration for the excellent way in which Dr. Mershon had presented his work.

Mr. H. C. VISICK said the paper contained many ideas which would prove helpful in the future. He had been interested to hear about the amount of tension which was necessary on the springs. In some cases he had been rather disappointed to find no movement after a month or even two months, and he had thought there must be something wrong with the material, because although a good wire it did not seem to produce any movement. But he now understood that one might wait for six months, and then perhaps he would be able to see results.

Dr. MERSHON said that he could not recall any case that would not respond to an auxiliary spring if the proper material were used. He did not know how many of his audience saw the clinic which his compatriot, Dr. Oliver, had in this country last year, but he would like in that connection to tell a little story which might explain the point. The circumstance which induced Dr. Oliver to use a lingual arch was this: One of Dr. Oliver's patients was coming close to Philadelphia to school, and Dr. Oliver recommended that while at school he should come to him (the speaker). The patient had an arch, very nicely made, with two auxiliary springs, and, of course, he (the speaker) would have let it alone, preferring to do as little as possible to another man's patients, but one of the springs which Dr. Oliver had placed on the patient broke off. He, therefore, replaced that spring; the time was about October, and the patient returned for the Christmas holidays to Dr. Oliver, who found that quite a great deal of movement had taken place on the side on which he (the speaker) had placed the spring, while on the other side there was no change. Next day he got a special delivery letter asking what appliance he used, and from that time onwards Dr. Oliver used the new material. The speaker said that this was no credit to himself, it was simply the material. With regard to the closing of the spaces between the central incisors, he thought that in the majority of cases in the deciduous teeth the upper central incisors came through apart; if they were mechanically brought together a condition would be produced which was the opposite to what was desired. Instead of a lateral development there would be contraction of the arch. But in a very large percentage of cases, when the laterals came down the incisors would come together.

In reply to a member who commented on the rest-periods which Dr. Mershon imposed, so that about half the time it took to treat a case was taken up by the rest-period, and asked if Dr. Mershon adopted intermaxillary traction and if so for what period, Dr. Mershon said that what one did *not* know about tooth movements would fill many books. It was important to remember that just in the proportion in which changes more rapid than the normal process were excited, disharmony was produced. He did give rest-periods, but that did not express just what he meant. He had used intermaxillary elastics, and had produced a certain amount of change; on letting these children go without their elastics for a time some of them relapsed a good deal, some not at all, but when he started again after the rest-period those cases went on easily. That, perhaps, was not a very intelligent observation, but it only expressed his observation in his practice. The lingual arch with him had been a development, not an invention and

he was still finding things out about it, and still changing his methods of treatment; he would feel sorry for himself if he was not. In practice in Philadelphia some things were imposed upon them by outside necessity. Philadelphia was a very hot city in the summer-time, and the private schools started closing in the last week of May, and by the beginning of July a large proportion of his patients were away from Philadelphia, and his office was closed from July to September. As a result of this he had made some discoveries. The children would go away, say, about the middle of June, and would start to return in the middle of September, though his practice did not resume entirely until some time in November. The children went away with a lingual arch very tight, and came back with it "all wobbling around," so that their parents would say, "This thing is doing no good, it is all loose." The uppers and lowers had hammered together, the children got hold of a lot of sticky candies. He discovered that when the appliance had been pulled out of its place the children did not relapse, because the thing had been long enough in position for adjustment and adaptation to take place. This led him to consider, "Well, these children have got to support themselves without an appliance some time. If the teeth will grow away from the appliance, why not take off the appliance?" and this he did. As to when this rest-period should be given he could not say, each case was a law unto itself. Some relapsed during the rest-period, but many improved. Among his patients who were now (June) going away after having been under treatment from the middle of October onwards, in the majority the appliances would be removed when they went away, and they would not return until October or November. From 80 to 90 per cent. of the cases in which the appliances had been taken off were improved. They returned in the fall better than they were when they went away.

In reply to a question from the same member as to whether there were any changes which took place in the molar teeth which were banded and were more or less fixed by the appliances, Dr. Mershon said that he did not know; he expected there were.

Mr. A. C. LOCKETT added a few words in appreciation of Dr. Mershon's paper. Its appreciation by the Society should not be measured by the length of the discussion. It was a different sort of paper from the papers they had been in the habit of having from abroad, but at the same time it was a paper which embraced a great deal of principle apart from detail. Dr. Mershon had, he thought, cleared up to a certain extent the doubts and uncertainties and fears which had existed in the minds of a great many orthodontists during the last few years. To put it perhaps more plainly, they had done their best to get as many of their friends from across the water as found it convenient to come over to bring out different points of view on this interesting subject and so help to eliminate difficulties. He need hardly refer to the demonstration of Dr. Oliver. That was principally concerned with technique and detail, but in the paper that evening they had had an honest confession of the difficulties which were found in America, the home of orthodontics, and it should cheer them up on this side, and show British orthodontists that they were not alone in their difficulties. The paper was interesting also as giving a point of view of the problems that were being thought out in America, particularly so in the light of the paper which was read at the last meeting of the European Orthodontological Society. These comparisons were very interesting and also helpful, and he hoped the day was not far off when it would be possible to arrive at some clear understanding both nationally and internationally on certain lines of work that would perhaps enable them to fight out their own national problems with greater success. He wished to thank Dr. Mershon again for this excellent paper, and for bringing before the Society the results of a long and hard-working professional experience.

Mr. MARSH asked what kind of material Dr. Mershon used for the lock wire. Some people in this country used a spring material of the same tensile quality as the auxiliary spring, and others used a soft wire.

Dr. MERSHON said that this was entirely optional and individual. He used the same wire for everything, not that he had any reason for doing so except a desire to reduce the variations of detail in his office as much as possible. He used the S. S. White wire for everything.

Mr. J. W. MAYER asked whether Dr. Mershon considered it practicable to use an apparatus which would be worn only at night—twelve hours' rest and twelve hours' use.

Dr. MERSHON said that he had no experience of this. It did not seem to him from the experience he had had of orthodontia in general that such an appliance would be applicable, except in a few cases.

Mr. CALE MATTHEWS said that there was so much to be said, but so little in criticism, that one hardly knew how to frame any remarks. To many members who were possibly only doing orthodontics when they were obliged, but who were profoundly interested in it, and desired to have an accurate knowledge of it, Dr. Mershon's remarks might be something of a disappointment. They had to remember when listening to a man like Dr. Mershon that he was one who did not realise his potentialities while he was talking to such an audience. Many of the things that were done by an experienced orthodontist were done intuitively and instinctively when it came to treatment. But what had been so profoundly interesting had been the breadth of view which Dr. Mershon had exhibited in treating the subject. He had carried that right through in a very clever paper and regular argument, and he had brought them to this point, that instead of being a matter of mechanical calculations, charts, measurements, and diagrams, orthodontics was a question of the treatment of the individual child, and that every child was a law unto itself in temperament, environment, heredity, locality, education, and every other thing that could be associated with the young human animal. How could it be hoped under those circumstances to draw charts and measure up on curves what it was desired to do in guiding the developing organism? There the matter must be left, because he was sure that if they had the opportunity of reading this paper later on it would furnish infinite food for thought. It was necessary to think of the subject quite in the broad way in which Dr. Mershon had developed it. It was quite noticeable that he tied them down to no hard and fast principles. He had in his modesty given credit for the results to the material, but it was not the material, it was the brain that placed the spring in the right position. Dr. Mershon perhaps did not quite realise that those whom he was addressing were not exactly in the position from which he started his argument; they had not behind them an experience extending to thousands of cases which had guided Dr. Mershon in dealing with the new cases which came along. The speaker desired to emphasise the value of the rest-period. He had often been surprised at the marvellous improvement which took place when the appliances had been left out for some considerable time. There was something in the physiology of this condition which was not yet understood. Some years ago he heard a conversation—he believed it was at a meeting of the Society—in which orthodontists were referred to as "tooth-pushers"; it gave him some misgivings because there was an element of truth in it, and it should not be so. The great lesson they must all have learned from Dr. Mershon that evening was to be careful and to be moderate in the forces they used, and generous to those who perhaps were not working on the same lines. He thanked Dr. Mershon for an instructive evening.

Mr. A. T. PITTS said that he had listened with very much pleasure to a paper whose title might have been "The Philosophy of Orthodontics," but it was difficult to keep the discussion on that high plane,

and he would like to ask questions on one or two practical points. What attitude did Dr. Mershon take up to cases of heredity and malocclusion—such cases as inferior protrusion where there was often a well-marked hereditary element? He was very much interested to hear what Dr. Mershon had to say about the treatment of the deciduous arch. There had been a good many advocates of that, but the speaker could not help thinking that the various exceptions Dr. Mershon made went some way to invalidate what he had to say. The function of the orthodontist was to give a gentle assistance to nature, and it appeared to him that assistance was likely to be most called for during the periods of active growth when the deciduous teeth were in place. He agreed with what Mr. Northcroft said about spaces between the centrals, and here he did not find Dr. Mershon's explanation entirely satisfactory. One frequently saw a case in which the central incisors by their separation had encroached on the spaces for the laterals, and though there were cases in which the eruption of the laterals brought them together, there were others in which it seemed desirable to give a little assistance to the laterals by drawing the incisors together.

Dr. MERSHON said that Mr. Pitts had broached a question which he had tried hard to keep clear from. It was a question as to which he must plead ignorance. That was the question of diagnosis. The problem of diagnosis was the most difficult problem in orthodontics. For anyone to take a child of six, seven, or eight, and to say what was likely to happen at from fourteen to eighteen was to assume a great responsibility. The problem of determining whether a case of malocclusion was an inheritance or acquired was one which he was not able to discuss. It was a question with which biologists had been dealing, and he did not feel himself sufficient of a biologist even to venture a guess. How, indeed, was one to determine the normal position of the teeth of human beings? It was possible only through the examination of hundreds and thousands of individuals to establish a normal for the species, and then one had to deduce from that what might be the normal for the individual. In the course of an observation on some five hundred children—a report on which would be forthcoming—there had been some startling shocks, particularly the number of malocclusions which had developed perfectly beautiful occlusions without ever being touched. Personally he treated about 60 per cent. of the cases that came to him; the others he kept under observation. With regard to the central incisors, to say that there were no spaces which had to be closed would be absurd, but he would say that in 98 per cent. of cases harm would be done by closing. As for the active period being at the time of the loss of the deciduous teeth, he granted that it was an active period, but it was so active he was afraid of it. The process which supported the permanent teeth was different from that which supported the deciduous.

The PRESIDENT, in closing the discussion, said that one of the things which struck him most in Dr. Mershon's address was his remark that they were dealing not only with the teeth but with the disharmony of the supporting structures, and the point that he had emphasised in treatment was that by the use of these gentle auxiliary springs the supporting structures were developed—at least that was how he interpreted him—probably more than with any other form of appliance. That was one of the vital things in the paper, and it pointed to one of the great conditions of success. He, too, had been amazed at the rapidity with which a change had taken place through the correction of the habit of thumb-sucking without any appliances in a child aged three years. It remained now for him to offer the thanks of the Society to Dr. Mershon for coming that evening, and spending really the first day of his holiday in extremely hard work on the Society's behalf. He called upon the members to express their appreciation of Dr. Mershon's kindness by very hearty applause.

The vote of thanks was accorded by acclamation.

POST-GRADUATE STUDY IN ORTHODONTICS.

Dr. MERSHON, at the invitation of the President, gave some account of a post-graduate school which had been established in America for the teaching of orthodontics. This was at the University of Pennsylvania, and was a real post-graduate school in the true sense of the word. It was headed by Dr. Roy Johnson, who in America was acknowledged to be the greatest mind in the orthodontic world. He was a teacher and he loved research, and was now doing the first really systematised research in orthodontics. He started last September, he took only a few students, and the course would be for one college year. He had established also a staff of men of a calibre of which he thought no other institution in the world could boast. This was the only place which the speaker knew of at present where men could go to be really educated as well as trained. He extended a warm invitation to members to attend the International Orthodontics Congress which was meeting in New York in August.

This concluded the proceedings.

REPORT OF THE EDUCATION COMMITTEE TO THE BRITISH SOCIETY FOR THE STUDY OF ORTHODONTICS.

List of Members of the Education Committee: J. H. Badcock, Chairman; Norman G. Bennett, F. Bocquet Bull, Harold Chapman, Sheldon Friel, G. F. Cale Matthews, H. T. A. McKeag, G. Northcroft, J. Lewin Payne, Bertram Samuel, Sidney Spokes; A. T. Pitts, Secretary, 1922; Harold Chapman, Secretary, 1925.

TERMS OF REFERENCE.—To consider the present method of teaching orthodontics in Great Britain and Ireland, to report thereon and to make recommendations, if thought fit.

1. *The Need for Orthodontic Treatment and the Results arising from Lack of Treatment.*

Irregularities of the teeth are frequently so gross as to constitute an obvious defect of feature often accompanied by perverted respiratory function, impaired biting power, and an increased liability to pyorrhœa and dental caries.

2. *The Present Deficiencies of Treatment.*

Admitting the necessity for the treatment of such cases, how is it met?

So far as a large section of the population is concerned, it is not met at all. A great number of children of the poorer classes do not receive any treatment. In the dental hospitals only a small fraction of those requiring attention receive it; in the school clinics such treatment is rarely undertaken except in so far as extraction of the teeth, unaccompanied by any supplemental regulation, suffices.

With regard to treatment in private practice, it would be a mistake to consider that the facilities for orthodontic practice are co-extensive with the number of practitioners. Actually many cases which could and should be treated, are not, even when the parents are willing to have it done. This branch of practice is not congenial to some dentists for various reasons, while there are others who would like to carry out orthodontic treatment but feel diffident of their ability.

Orthodontics is admittedly a branch of dentistry which not only calls for high technical skill, but also needs much experience in diagnosis and prognosis, and although many dentists may feel themselves competent to carry out the details of treatment, they do not always feel able to make the preliminary diagnosis which involves a decision as to the methods to be employed.

The student qualifies, knowing less of orthodontics than of any other branch of dentistry.

It stands somewhat apart from the rest of dentistry, and the evolution in skill and knowledge which every dentist may reasonably hope for, may leave his knowledge of orthodontics stationary.

3. *The Desirability of Instituting Special Instruction in Orthodontics.*

It is desirable that special instruction should be given in our teaching schools so that the student may at least know the elements

of the subject. Knowing these, he will have a basis on which to build, and if he so desires, can set out to become specially skilled in orthodontics. If his desires should not lie in that direction, he would still be able to recognise his limitations in regard to difficult forms of malocclusion and the possibility of their treatment by those with a wider knowledge of the subject.

Out of this arises the question as to whether one member of the hospital staff should be entrusted with the whole of the teaching of orthodontics so that, in effect, he becomes the orthodontic specialist on the staff, or whether all members of the staff should take their turn in treating orthodontic cases and giving clinical instruction on their visiting days. In a few dental schools the former method is in vogue, but in the majority all members of the staff are, in theory, equally responsible for orthodontic treatment and instruction.

The Committee feels that there should be a member of the staff in charge of the orthodontic department, responsible for all treatment of the patients. The main body of the teaching to the students, both theoretical and practical, would naturally fall to this member of the staff. At the same time the Committee is of the opinion that it would be unwise to debar other members of the staff from teaching. This could be arranged without lessening the administrative authority of the dentist in charge of the orthodontic department.

The Committee suggests the following as a Model Scheme of Undergraduate Education in Orthodontics :—

A course of instruction in orthodontics should be compulsory and should include technical work, lectures and clinical work, as follows, viz. :—

1. *Technical work (in the laboratory, accompanied by lecture demonstrations).*

This course should consist of :—

- (a) Casting impressions and the preparation of the model.
- (b) Free-hand soldering technique and wire bending.
- (c) The construction of plain bands to fit natural teeth, by direct and indirect methods.
- (d) The construction of simple appliances, removable and fixed, on models and phantoms respectively.
- (e) The construction of various devices to retain removable appliances.

2. *Lectures on the Theory and Practice of Orthodontics.*

These lectures should form a special course and not be included in the course of lectures on Dental Surgery. This is desirable so that orthodontics may not be submerged by the other subjects which must inevitably form the greater part of the syllabus of lectures on Dental Surgery, and to give it a position in the curriculum worthy of its importance.

With regard to the lectures themselves, it is obvious that their arrangement and subject matter must vary with the views of the lecturer; nevertheless there is common ground as set forth in the following syllabus:—

1. The definition and aims of Orthodontics.
2. A short history of the subject.
3. Definition of terms and phrases.
4. Morphology.
5. Normal development, growth and relationship of the jaws and associated bones and teeth and the natural forces which influence them.
6. Forces governing the eruption and arrangement of the teeth.
7. Normal occlusion and the factors producing it.
8. Normal variation.
9. Effect of function on form and growth.
10. Etiology of malocclusion : (1) Hereditary causes.
 - (2) Congenital „
 - (3) Pathological „
 - (4) Functional „
 - (5) Dietetic „
 - (6) Local „
11. Models, X-rays and photographs.
12. Diagnosis and Classification.
13. Prognosis.
14. Treatment : (1) Preventive.
 - (2) Remedial.

(a) Surgical	}	Retention.
(b) Mechanical		
(c) A combination of both <i>a</i> and <i>b</i>		
15. Factors influencing the choice of treatment.
16. Case recording, charts, and preservation of data.

3. *Clinical Work.*

The student should hold a dressership of not less than three months in the orthodontic department.

This should comprise instruction in:—

- (a) The taking of impressions in plaster and other materials.
- (b) Diagnosis and charting.
- (c) Treatment by extraction.
- (d) By surgical methods other than extraction.
- (e) By appliances.
- (f) By a combination of any or all methods (c), (d) and (e).

At the end of each course of lectures a class examination is desirable.

It is earnestly recommended that greater stress should be laid on this subject, and that orthodontics should form a separate subject in the examination for a diploma or degree.

POST-GRADUATE INSTRUCTION IN ORTHODONTICS.

There should be facilities for post-graduate instruction in orthodontics in connection with all dental schools. Post-graduate teaching might be of two classes :—

- (a) As for undergraduates, with such modifications as might be necessary to meet special conditions.
- (b) A more detailed course for those fitted to receive it.

Courses for short periods held at times which might be most convenient to dentists in practice, would probably be found the most suitable arrangement and meet a much-felt want. This would necessitate special classes in practical and theoretical work apart from those held for the benefit of the students.

(Signed) J. H. BADCOCK, *Chairman.*

APPENDIX.

THE following expanded syllabus is suggested as a guide for teachers and may be varied to suit the curricula of various schools and examinations, e.g. the L.D.S., B.D.S., etc. The numbers of the headings in the appendix will be found to correspond with the numbers in the model scheme. The appendix concludes with suggestions for case-taking and the references, which are referred to by numbers at the end of each section of the appendix.

I. TECHNICAL WORK IN THE LABORATORY, ACCOMPANIED BY LECTURE DEMONSTRATIONS.

The taking of plaster impressions, e.g. one student by another student.

Casting impressions and the preparation of the models.

Free-hand soldering technique and wire bending, e.g. soldering a circle of wire inside a square inside another circle.

The construction of plain bands for anterior teeth.

Labial "pull-to" joint or "squeeze" joint; lingual "pull-to" joint, "overlap" joint.

The construction of plain bands for posterior teeth by the (i) direct method, (ii) indirect method.

The construction of simple appliances, removable and fixed, on models and phantoms.

The construction of various devices to retain removable appliances.

2. LECTURES ON THE THEORY AND PRACTICE OF ORTHODONTICS.

1. *The definition and aims of Orthodontics (Dental Orthopædics, Odonto-Prosopic Orthopædics):—*

Orthodontics includes the study of the growth and development of the jaws and face particularly, and the body generally, as influencing the positions of the teeth, the study of the action and reaction of internal and external influences on this development, and finally the prevention and correction of perverted and arrested development. The aims of orthodontic practice are to obviate the evils set out in the first part of this report, and should be both preventive and curative.

References: Nos. 1, 2, 3, 4, 5, 15.

2. *Terms and phrases should be defined as they arise, special attention being paid to the following:—*

(1) "Science," (2) "Heredity," (3) "Phylogeny," (4) "Ontogeny," (5) "Recapitulation Theory," (6) "Morphology," (7) "Growth and Development," (8) "Physiological and Chronological Ages," (9) "Function," (10) "Diagnosis," (11) "Prognosis."

Great confusion results from the loose use of such terms, both in understanding problems and in conveying ideas to others.

3. *The Morphology of the Deciduous and Permanent Teeth:—*

A knowledge of the form, grooves and cusps of the teeth is essential in the study of occlusion.

References : Nos. 6, 7.

4. *Embryology of the Face and Jaws ; showing how particular forms in later life may represent survivals of embryonic stages.*

Reference : No. 8.

5. *Development, growth and relationship of the jaws, associated bones and teeth, and the natural forces which influence these.*

I. Anatomy of cementum, periodontal membrane, alveolar and basilar bone.

II. The physiology of the following :—

(A) Periodontal membrane.

(B) Bone.

(i) Limited as to its growth and development by heredity, but modified as to its form and structure by function and nutrition.

(ii) Differentiation between—

(a) bone depending wholly on function for its development, e.g. alveolar bone, which is dependent on the presence of teeth and modified according to the stresses to which these are subjected ; and

(b) bone (e.g. basilar bone), in the full development of which both heredity and function play a part.

(iii) Adaptability of form and structure of bone.

(iv) Wolff's Law of Bone Transformation.

(v) Oppenheim's Experiments.

(c) Muscles.

(i) Group and counter-group system, showing that muscles do not act singly.

(ii) Development of antagonising muscle groups.

(iii) Muscle tone.

(iv) Muscle less adaptable than connective tissue structures, e.g. bone.

(D) Eruption of Teeth.

References : Nos. 9, 10, 11, 12, 13, 14, 15, 16, 17, 17A, 17B, 17C.

6. *Factors influencing the arrangement of the teeth, e.g. :—*

Approximal contact points.

Interdigitation of cusps.

Muscular pressure.

Heredity. (See 9 I.)

Habit. (See 9 II.)

References : Nos. 5, 6, 7, 21, 30.

7. *Effects of function on form and growth.*

Reference : No. 17.

8. *Occlusion.*

I. Definition of occlusion.

II. Occlusion the basic principle of orthodontics.

III. The functional significance of the surface detail of each tooth.

IV. Meaning of the word "normal."

V. Three standards of occlusion : (1) Hypothetical ideal, (2) Typical, (3) Functional.

VI. The functional standard governs all conceptions of treatment, whether that function be mastication, respiration or speech.

References : Nos. 18, 19.

9. *Some factors influencing occlusion.*

I. Heredity :—

- (A) Weissman's Theory ; Mendelism ; Neo-Lamarckism.
- (B) Inborn and acquired characters ; environment.
- (C) Mutations and reversions.
- (D) Variations.
- (E) Quantitative and Qualitative, Continuous and Discontinuous Variations.

II. Habit :—

- (A) Tendency to repetition a normal characteristic of living tissue.
- (B) Influence of habit on function a large factor in determining development.

III. Normal Variation.

- (A) Individual occlusion a problem of normal variation. Application of Law of Variation lies in distinction between individual variation and malocclusion.

References : Nos. 20, 21, 22, 23.

10. *Etiology of malocclusion.*

I. Heredity.

II. Congenital conditions.

III. Pathological conditions.

- (A) Effects of Constitutional Diseases.
- (B) The effect of abnormal internal secretions on growth and development of the teeth and jaws.

IV. Functional causes ; Habits ; Muscularity.

V. Diet considered chemically and physically.

VI. Local conditions which interfere with the development of the jaws and alignment of the teeth.

References : Nos. 1, 2, 15, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34.

11. *Models, X-rays and Photographs.*

12. *Diagnosis and Classification.*

Classification of malocclusion :—

Angle's, Bennett's, G. Villain's.

Terms used to denote malocclusion.

Methods and instruments employed, e.g. :—

Prosopometer ; Symmetroscope ; Dynamometers.

References : Nos. 1, 2, 15, 35, 36, 37, 38, 39, 40.

13. *Prognosis.*

Age, Heredity, Social conditions, Health and Personal characteristics.

Reference : No. 41.

14. *Treatment.*

I. Preventive.

- (A) Care of deciduous dentition.
- (B) Extraction of deciduous teeth.
- (C) Splints after loss of deciduous teeth.
- (D) Cure of bad habits.
- (E) Surgical (adenoids and tonsils, etc.).
- (F) Diet.
- (G) Exercises.

II. Remedial.

- (A) Surgical. Extraction, immediate rotation and translation.
 - (B) Mechanical.
 - Mechanical principles employed in orthodontic appliances.
 - Action and reaction.
 - Resultant of forces.
 - Levers, orders I, II, III.
 - Elasticity.
 - Inclined planes.
 - Wedges.
 - Anchorage* : Definition and application.
 - Simple, stationary, reciprocal, etc.
 - Relation of the physiology of dental and associated structures to the design of orthodontic appliances.
 - Physiology of tooth movement.
 - Necessity for minimum interference with function.
 - Appliances for the development of normal function.
 - Materials used in fixed and removable appliances.
 - Properties of materials as applied to various purposes.
 - Exercises.
 - (C) A combination of (A) and (B).
- The importance of hygiene during treatment.

References : Nos. 1, 2, 3, 4, 42, 43.

15. *Factors influencing the choice of treatment.*

- I. Age.
- II. Attendance.
- III. Health conditions, dental and general.
- IV. Social conditions.

Reference : No. 44.

16. *Case recording, charts and preservation of data.*

References : Nos. 15, etc.

3. CASE-TAKING.

(*Vide* suggestions at the end of the Syllabus.)

4. CLINICAL WORK.

This should comprise instruction in :—

- (A) The taking of impressions in plaster and other materials.
- (B) Diagnosis and charting.
- (C) Treatment by extraction.
- (D) By surgical methods other than extraction.
- (E) By appliances.
- (F) By a combination of any or all methods (C), (D) and (E).

SUGGESTIONS FOR ORTHODONTIC CASE-TAKING.

Number. Date of Examination. Patient's Name. Age. Sex.

GENERAL HISTORY.

DIET.—*First Year*.—Natural. Artificial. Mixed. What foods? *Years 1-6. Present Time*.—Breakfast. Dinner. Tea. Food after tea. Sweets. Fruit.

BREATHING.—Day. Night. Windows at night. Shut. Open. If by mouth state : (1) Cause ; (2) Age of onset ; (3) Degree ; (4) Date when nasal breathing re-established.

NOSE.—General development. Anterior Nares (Right—Free ; Obstructed. Left—Free ; Obstructed).

TONGUE.—Small. Large. Muscular. Flabby.

LIPS.—Small. Large. Muscular. Flabby.

HABITS.—Harmful, e.g. thumb-sucking, lip-sucking, etc.

CORRELATED HABITS.

GENERAL HEALTH.—Physique. Sitting height. Total height. Weight.

Tonsils—Healthy; Diseased. Adenoids—Absent; Present. Illnesses.

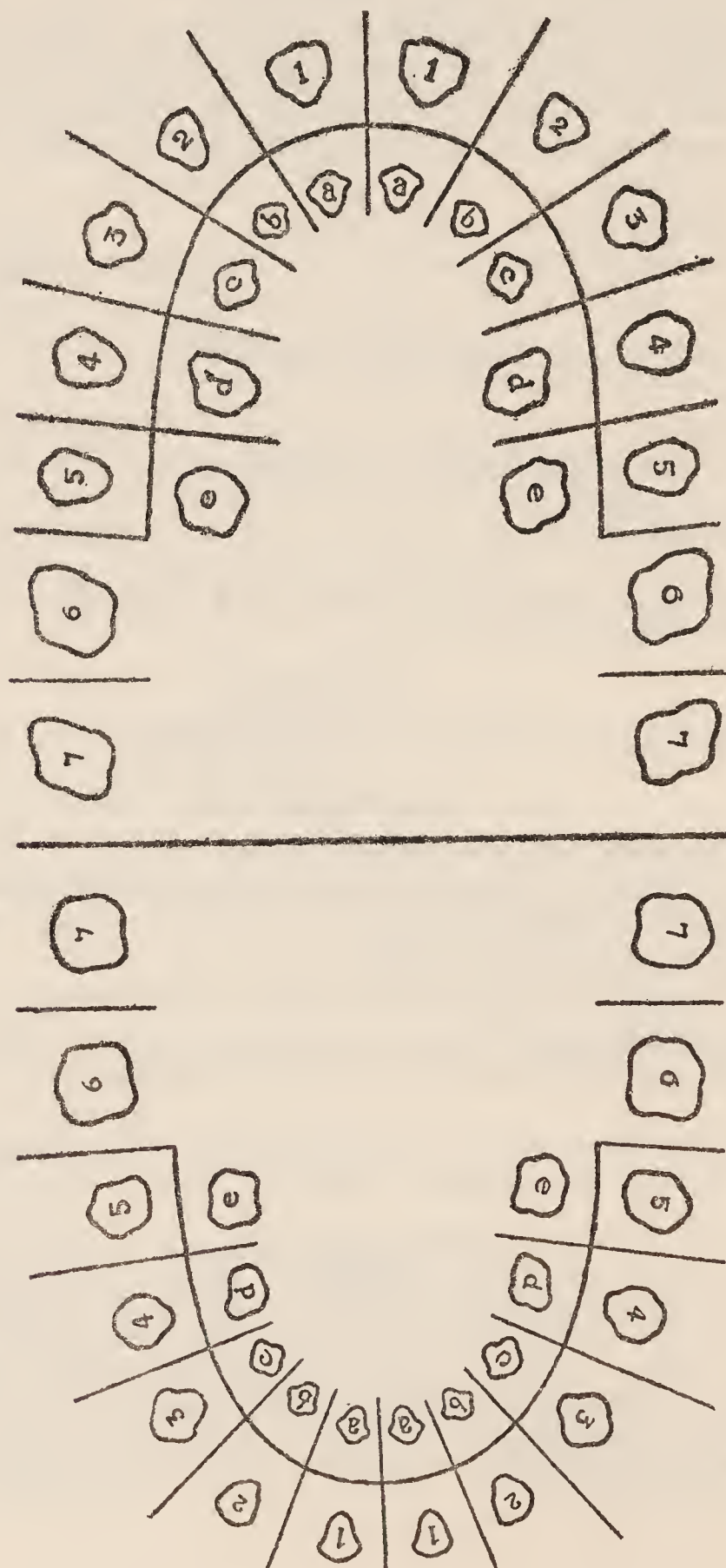
Hereditary Factors.

DENTAL HISTORY.

General condition of the Mouth—Clean; Dirty. Use of Toothbrush. Developmental defects of teeth. Gums. Fræna. Caries—Absent; Degree. Deciduous teeth retarded in eruption. Permanent teeth retarded in eruption. Deciduous teeth retained. Teeth erupting out of recognised order. Deciduous teeth spacing naturally—Yes; No. Supernumerary teeth. Radiographs show. Date. Photographs—Front, right and left profile. Note the variation from normal in the patient's face. Date. Mastication—Normal; Vigorous; Feeble. Orthodontic family history.

Indicate on a chart the position of each tooth.

SUGGESTED CHART.



INSTRUCTIONS FOR COMPLETING CHART.

1. If the tooth is in its normal position draw a line through the numeral at right angles to the numeral.
2. If the tooth is in a position mesial to normal draw a line at right angles but distal to the numeral.
3. If the tooth is in a position distal to normal draw a line at right angles but mesial to the numeral.
4. If the tooth is in a position labial or buccal to normal draw a line at right angles but labial or buccal to the numeral.
5. If the tooth is in a position lingual to normal draw a line at right angles but lingual to the numeral.
6. If a tooth is in a rotated position draw a line at the angle and position of rotation.

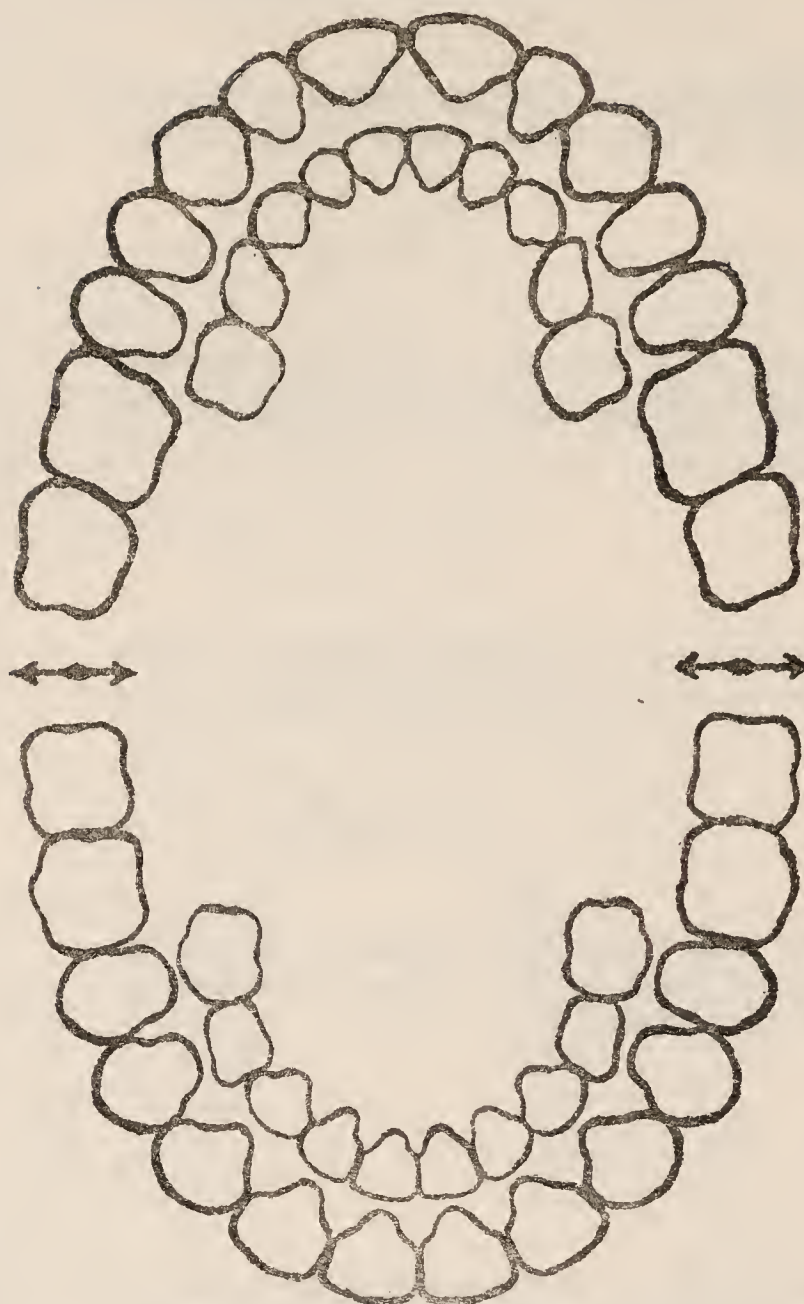


Draw a diagram of the occlusion of the teeth (right and left sides) and make a note of the antero-posterior relation of $\frac{6|6}{6|6}$ $\frac{3|3}{3|3}$ and $\frac{e|e}{e|e}$ $\frac{c|c}{c|c}$ or $\frac{e|e}{e|e}$ $\frac{c|c}{c|c}$

Indicate on a chart the following :—

Teeth lost ...	...	...	...	by	×
Teeth congenitally absent	...	...	...	by	□
Teeth erupting ...	...	...	...	by	Λ
Caries by outline of cavity	...	...	...
Fillings by outline blocked in	...	...	...
Roots, carious ...	...	...	...	by	rt.
Pulp involved ...	...	...	...	by	p.
Hypoplasia ...	...	...	...	by	H.

SUGGESTED CHART.



GENERAL CHARACTERISTICS.—Body—Broad; Slender. Face—Square Round; Oval.

RELATION OF ARCHES TO CRANIUM AND FACE.*—*Antero-posterior*.—Upper—Normal; Post-normal; Pre-normal. Lower—Normal; Post-normal; Pre-normal.

GENERAL CHARACTER OF DENTAL ARCHES.*—*Antero-posterior*.—Upper—Normal; Short; Long. Lower—Normal; Short; Long. *Lateral*.—Upper—Normal; Narrow; Broad. Lower—Normal; Narrow; Broad. *Vertical*.—Upper—Normal; Deep; Shallow. Lower—Normal; Deep; Shallow. *Centre Line*.—Upper—Correct; to the right; to the left. Lower—Correct; to the right; to the left. *Overbite*.—Edge to edge; Slight; Medium; Excessive. Note drifting of teeth from normal positions.

Classification—Angle; Bennett.

Summary of previous facts—Etiological; Diagnostic.

Prognosis (give reasons).

Suggested Treatment.

REFERENCES.

ABBREVIATIONS.—*Trans. B.S.S.O.* = *Transactions of the British Society for the Study of Orthodontics*. *B.D.J.* = *British Dental Journal*. *D.R.* = *Dental Record*. *J.D.R.* = *Journal of Dental Research*. *I.J.O.* = *International Journal of Orthodontia*. *D.C.* = *Dental Cosmos*.

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SOME CONSIDERATIONS OF RECENT RESEARCH INTO THE GROWTH AND FORMATION OF BONE, WITH SPECIAL REFERENCE TO ITS BEARING UPON ORTHODONTIC PRACTICE.

By LILIAN LINDSAY, L.D.S., AND ROBERT LINDSAY, L.D.S.

My husband and I have found ourselves confronted by the problem of reconciling our duty as members of this Society, which impels us to take an active part in its proceedings, with the disability which cessation of practice imposes on those who would desire to enter on a field of discussion where practical experience counts for so much.

It has been our fortune, however, both at meetings of this Society and elsewhere, during comparatively recent times, to listen to papers and lectures in which the results of research in the development of the bones of the face and jaws, and into the manner of the growth and transformation of bone, were set forth by men who spoke with authority.

These investigations necessarily bore prominently on the science of orthodontics, in fact their ostensible purpose was an attempt to discover from the theoretical and experimental study of the normal growth of the jaws and the associated parts of the skull, the cause or causes of those abnormalities in the arrangement of the teeth in the alveolar arches and in the relations of the jaws, which it is the work of the orthodontist to treat. We were constrained to speculate on these matters and to question in our own minds to what extent the conclusions arrived at tended to affect prevailing theories and practice. Whether we have been wise in giving expression to these questionings we may hope to learn at a later stage in the proceedings.

In considering such a subject as this it was natural that our thoughts should be directed to the laws governing growth, and particularly to that law, which has been held to dominate the growth and formation of bone, associated with the name of Julius Wolff. Here is the rendering of Wolff's law given by the American, John B. Murphy: "The amount of growth in a bone depends upon the need for it."

Within well-defined limits that may be accepted as a satisfactory statement of the law of normal growth as expounded (for example) in the paper read by Sir Arthur Keith and Mr. G. G. Campion before this Society on December 5th, 1921, in which the normal development of the bones of the face from birth to the adult state was shown to be dependent upon definite and co-ordinated increments of growth at certain sutural and other points. In a broad and general sense normal development results in the growth of bone "*where it is needed.*"

But however simple and attractive Murphy's rendering may be, it is not Wolff's law, and as Wolff's law is frequently spoken of in orthodontic discussion, a short statement of how that law came to be formulated and what it really is may not be out of place here.

In the year 1838 Ward, an English anatomist, likened the upper end of the femur to a wall bracket bearing a lamp, a figure which

he used to demonstrate the lines of pressure and tension in certain positions of the body in relation to the lower extremity. These figures represent the different ideas held by other investigators—Jacob, Wyman, Engel, Meyer, finishing with Wolff's own conception in 1870. In 1867, at a meeting in Zurich, Meyer, a German anatomist, was exhibiting a frontal section of the head and neck of the femur, when Culmann, a professor of engineering (described as the founder of graphostatics), who was present, saw in the lines of the cancellous bone shown by Meyer the resemblance to the trajectorial lines of pressure and tension which he was accustomed to demonstrate to his students in explaining the structure of cranes.

Another twenty years elapsed, during which Julius Wolff, the orthopædist of Berlin, was engaged in the study of this question of bone formation. He visited Culmann, and finally published in 1892 a mighty quarto entitled "*Das Gesetz der Transformation der Knochen*," beautifully illustrated with diagrams and photographs. In this work he claims to have originated the law that where-soever stresses of pressure and tension are caused in a bone, be it by pressing forces or by pulling forces, formation of bone takes place.

A comparison of the diagrammatic rendering of the trajectorial lines of pressure and tension in the crane and in the upper part of the femur, as shown diagrammatically by Meyer, with the actual structure of the bone, particularly as shown in photographs of sections of the bone, would appear to justify the remark of Murk Jansen, that—"Similarity was taken for identity, without any further proof being considered necessary."

From this Wolff deduced the theory that not only the *internal* structure but also the *external* form of bones and of the organs of living beings were determined by the mechanical forces acting on them, and that in particular the trabeculæ of the cancellous bone were laid down or built up along the lines of pressure or tension, crossing each other at right angles as in the manner laid down by graphostatics and illustrated in the diagram of the Fairbairn crane. This he designated the law of Orthogonality.

Wolff's law would appear to stand or fall upon the question whether static laws applicable to the structure of cranes are relevant to living structures, particularly to such a plastic and constantly changing tissue as bone. As opposed to such a mechanical theory, we prefer the view of Jennings as quoted by Baylis in his "*Principles of General Physiology*": "It is of the very greatest importance for the understanding of the behaviour of organisms to look upon them chiefly as something dynamic, as processes rather than as structures. An animal is something that happens."

What may be described as the reasonable interpretation of Wolff's law, namely that within certain limits and *apart from primary growth*, pressure or tension to which the bony elements are subjected affect the formation of bone, appears to be demonstrated in Albin Oppenheim's paper on "*Tissue Changes Incident to Tooth Movement*" (which has been referred to previously in this Society in another connection), in which he sets forth the results of certain experiments on the teeth of young baboons, which were subjected to movements common to orthodontic practice. The paper is

probably familiar to members, and we simply desire to draw attention to certain points which appear to bear out experimentally the theory enumerated by Wolff.

Lantern slides were exhibited to illustrate the changes in bone incident to tooth movement, particularly the effect of slow, gentle and, as Oppenheim expresses it, physiological action—also that such action results, as Wolff claims, in transformation of structure in the direction of the force applied. The conclusions arrived at by Oppenheim are that movement must never be rapid or powerful, that the gradual and continuous effect of a spring is preferable to the intermittent action of the screw. Only under gentle movement does bone reconstruction take place, and the slower the movement the shorter is the time necessary for subsequent retention, because during these slow continuous movements the tooth is not loosened, the firmness of the tooth during movement being the criterion for the correctly measured force; time is given for deposition to gain over absorption, and there is less chance of injury to the vitality of the growing bone.

Though, as claimed by Oppenheim, Wolff's law finds a certain amount of confirmation, the interpretation given to this law by Murphy, that "the amount of growth in a bone depends upon the need for it," would appear to be disproved by the result of the application of intense force; under which not only does no transformation take place, but there is, if anything, a compression and consequent thinning of the bone.

There was just as much need here for the changes shown in the other cases, but the degree of the force applied prevented them from occurring.

We now turn to a different aspect of this subject, namely the consideration of certain points which emerged in the post-graduate lectures of Professor Brash, delivered last year on "The Growth of the Jaws and Palate" and on "The Genesis and Growth of Deformed Jaws and Palates."

This, indeed, was the original cause of the writing of this paper, not that we presumed for a moment to suppose that we could possibly add anything to what Professor Brash had said on the development of the bones of the face and jaws, normal or abnormal, but because it appeared to us that opportunity to discuss certain of the conclusions arrived at would be welcomed by many members of the Society, in order that any advance on or corroboration of previously held opinions might be noted and substantiated and any difference of view expressed.

In these lectures the normal and abnormal conditions of growth of the jaws were discussed from two different aspects: the normal by an experimental demonstration of the methods of growth of bone as shown by the madder feeding of young pigs, the abnormal by an exhaustive investigation of the statistical methods of Franke: with a view to determining the facts and the direction in which the causes of abnormalities in the growth of the jaws might most profitably be sought. Out of a wealth of valuable and suggestive material we select three points only.

First we would refer to what appeared to be shown in the madder feeding experiments with reference to the cause of the eruption of the teeth.

The cause of eruption of the teeth is one of perennial interest to dental surgeons engaged in orthodontic practice, and every writer on dental anatomy and surgery from the very earliest times has dealt with it. The present position is summed up by Mr. J. Howard Mummery after a short consideration of each of the chief theories advanced in recent times, in the 1924 edition of his "Microscopical Structure of the Human Teeth," in the following words:—

"Though we have some knowledge of the phenomena accompanying the process, the actual conditions necessary and the forces which govern the process of eruption of the teeth are still very imperfectly understood."

Anything which seems to promise a nearer approach to certainty in this matter is worthy of notice and the emphasis laid by Professor Brash on surface and sutural growth as the *sole* agencies in increase in size of the bones of the jaws, as demonstrated by the specimens exhibited, appeared to us to throw new light on this very important matter. It is obvious that in the lower jaw, for example, where there is no sutural growth (although this is held to be equally true of the upper where there is) that the walls and floors of the alveoli and of the crypts containing the developing teeth are "surfaces" which are covered by periosteum, and where therefore deposition of bone will take place.

The method of mixing madder with the food of young animals during definite periods of time, thus producing staining of the bone laid down during the period, followed by periods of ordinary feeding prior to the killing of the animals and the preparation of the specimens, is well known and recalls the classic experiments of John Hunter.

It is not out of place to recall the fact that Blake, a Dublin dentist, in his book on "The Teeth," published in 1799, describes similar experiments in young animals in which even staining of the dentine was manifest.

The special feature which we desire to refer to is that in addition to this active deposit of bone on all the outer surfaces of the jaw, there is also active deposition on the walls and floors of the alveoli of the temporary teeth. The space which in the live animal would contain the remains of the enamel organ may be noted here, and that path of least resistance noted by Messrs. Warwick James and Pitts, along which the tooth would advance most easily to the surface, assisted by those changes in the oral epithelium which they have likened to the opening of a book.

This deposition of bone is shown in slides exhibiting sections of the upper jaws, where, in addition to active deposition in the median palatal suture and on the palatal crest with the corresponding absorption on the floor of the nasal cavities bone growing "where it is needed" in response to the living energy of the tissues, and also by the deposition of bone on the under surface of the palatal process of the superior maxillæ by which lowering of the roof of the mouth is effected, an important point to which further reference will presently be made; we have again the evidence of active deposition of bone taking place on the internal aspects of the alveoli of these molar teeth.

This of course is not new. It is in fact an experimental demonstration of the theory of eruption advanced by Mr. Alfred Coleman

in 1867, in which his reference to "bone currents" has had attached to it probably an erroneous meaning and significance, by certain of the critics of that theory.

In accepting this activity of bone growth as a factor in eruption, it is not necessary to postulate continuous movement. The bone forming cell is like other living cells in this respect, that its activity is not shown by continuous action but by short periods of activity followed by variable periods of apparent rest and recuperation, and this agrees with what is known of the process of eruption which, while orderly, is in a sense intermittent.

To recognise this force as a definite factor in eruption does not necessarily exclude the participation of any of the other agencies which have from time to time been advanced, except, perhaps, the theory of blood-pressure advanced by Constant. The anatomical relations of the structures almost imply in fact the participation of the oral epithelium which was postulated alike by Thornton Carter, by Warwick James and Pitts, and others as a part of the eruption process.

The process to which we have been referring is part of the normal development of the jaws which Professor Brash finds fully accounted for by that surface deposition of bone upon which he is insistent as opposed to the theory of interstitial growth, and which is a necessary condition if bone growth is to be recognised as an eruption force.

Professor Brash proceeds to test the conclusions to which the results of his experimental method seem to point by a consideration of the researches into the normal and abnormal changes in the dental arches from the period of birth onward. While noting the results obtained by British investigators, he is driven by the limited number of individual cases on which these results were based to adopt for the purposes of his examination the very extended investigations of Franke as set forth in his "Über Wachstum und Verbildung des Kiefers und der Nasenscheidewand auf Grund Vergleichender Kiefermessungen und experimenteller Untersuchungen über Knochenwachstum."

This work, which unfortunately is not available in an English translation, contains the result of the examination of 1,200 skulls and 200 models of subjects of all ages and stages of growth.

Whether we find ourselves in agreement with the deductions of Franke or with the method by which he reached them, there can be but one opinion as regards the value of such an exhaustive investigation, and the fact that Professor Brash has found that certain of Franke's conclusions are not antagonistic to the principle of growth as deduced from his own investigations of the normal growth of the jaws, adds to the weight of these conclusions and to the necessity for a serious consideration of them.

It is in Professor Brash's exposition of Franke's figures and diagrams indicating the extent and manner of growth of that portion of the jaws containing the temporary teeth and their permanent successors that we find the second point which we wish to notice.

As he is dealing with a question of *bone growth*, Franke discards the teeth as points of measurement and adopts certain alveolar points instead. Franke measures the length through the centre of the alveoli from left to right along the mid-alveolar line. The

breadth is measured at three separate points by a series of transverse lines of which the anterior breadth line meets the length line on each side immediately posterior to the second premolar or the second temporary molars.

The posterior breadth line is a similar line 10 millimetres further back and the middle breadth line meets the length line intermediately to the anterior and posterior lines and corresponds to the centre of the alveoli of the first permanent molars.

The height of this arch, which is formed by the curve of the mid-alveolar line from the base formed by the anterior breadth line, is shown by a perpendicular drawn from the mid-alveolar line between the alveoli of the central incisors to meet the anterior breadth line.

Franke took measurements on each of these lines over the number of skulls and casts at his disposal for age groups of 2 to 7, 8 to 13, 14 to 21, 22 to 29, 30 to 50, and plotted his results in a table, which showed average increases in breadth in the maxillæ and mandible and decreases in *height* of the arches as well as in *length* of the mid-alveolar line.

The points to be noted are that growth in the maxillæ is nearly double that in the mandible and that in both maxillæ and mandible the increase is greatest in the 2 to 7, 8 to 13 periods, as was to be expected.

While the *breadths* increased, the *lengths* of the mid-alveolar lines decreased, in the maxillæ by 2.0 m.m., in the mandible by 4.1 m.m., and decrease in the height of the arch was equally apparent, though differences between the maxillæ and mandible were not so great, being 3.6 m.m. in the maxillæ, 3.7 m.m. in the mandibles.

The decreases in the heights of the arches are easily explainable : when the breadth of an arch is increased the height necessarily is reduced by the flattening which the increase in breadth produces, but the decrease in the length of the mid-alveolar line of 2 m.m. in the maxillæ and 4.1 m.m. in the mandible is not so easily explained, and certainly not by Franke's assumption that the permanent teeth occupy a smaller area than their temporary predecessors, as is graphically shown in a diagram in which Franke superimposes the temporary and the permanent arches of the maxillæ and of the mandible, where the increase in breadth is shown behind the point of intersection of the arches in the selected points of breadth measurement, with the consequent reduction in *height* of the arch due to this spread amounting to 3.6 m.m. in the maxillæ, and of 3.7 in the mandible is shown here.

Certain weaknesses of the statistical method inherent in deductions from the measurements of skulls and casts are apparent here. For example, as Professor Brash noted in his lecture, the shortening of the length of the mid-alveolar line may really be due to the advance of the first permanent molar. In fact, it would appear that the decrease must be accounted for largely by such a forward movement of the base. It is difficult to understand how a movement which is a commonplace experience of every orthodontist can have been ignored by Franke ; and again, while it is undoubtedly the case that the permanent incisors both upper and lower erupt normally behind the corresponding temporary teeth, this is emphatically not the case with the canines, and to plot such

curves as these showing the alveoli of the permanent canines in such relation to the temporary canines is to invite criticism.

The third and last point which we desire to notice concerns certain deductions which Professor Brash drew from the comparative measurements of normal and abnormal jaws as set forth by Franke, which pointed to interesting variations of generally accepted views as to these deformities.

It has been freely assumed, for example, that a chief cause of those irregularities with which the orthodontist has to deal is lack of growth in the jaws.

A study of Franke's figures shows that the average amount of growth is not much less in the abnormal than in the normal jaw.

The point which we wish to notice in this connection is the height measurement—normal and abnormal—and the fact that there is comparatively little difference between them. In the normal there is a total increase of 6.6 m.m., while in the abnormal it is a little over 7 m.m., but the important point emphasised by Professor Brash here is that the difference in height (amounting to 3.0 m.m.) between the normal and the abnormal palates at the 2 to 7 age period does not increase in greater ratio during the later age periods, but remains practically constant.

This is shown in a diagram where it is apparent that although the abnormal palate is higher in the earliest age group by 3 m.m. the ratio is not increased in the later age groups. Therefore, whatever the cause of the height of the abnormal palate may be, that cause is present at an early age and may not unreasonably be ascribed to some developmental defect rather than to mechanical, muscular or nutritious influence at a later age, as has been hitherto done.

As an alternative to early exhaustion of the growth force in these abnormal jaws, as an explanation of this, Professor Brash deals with the possibility that height and narrowness of the palate may be due to a normal growth associated with a variation in the angle of downward growth of the alveolar process in relation to the palate.

The normal inclination of the alveolar process to the palate has been taken by Professor Brash at 90 plus 18 degrees, which simply means that in the normal jaw the direction of the alveolar process is downward and slightly outward. Anything which, either in classes or individuals, tends to reduce that angle of inclination introduces a possible cause of deficiency in breadth of the adult palate. If the inclination be reduced, for example, from 18 to a lesser degree, then it is obvious that the lessened spread of the alveolar process would require to be compensated for in one of two ways, either by growth at the median palatal suture or by a greater downward growth of the alveolar process which latter, were it continued sufficiently, would compensate for the lesser inclination of the process. If the angle were reduced to 90 and the downward growth of the process therefore perpendicular, any increase in breadth must necessarily be obtained by growth at the median palatal suture, while were the angle of downward growth further reduced beyond the perpendicular, increasing growth downward would produce progressive narrowing of the palate which could only be modified, but not corrected, by growth at the median suture.

This latter condition would appear to afford a possible explanation of certain cases of saddle shaped jaws, illustrated in a work by the late Sir Thomas Clouston, "Neuroses of Development," published in 1890, in which he dealt with the relation of abnormal palates to neurotic conditions and to congenital insanity, and in which the shapes of his abnormal palates in the neurotic and the insane have a striking similarity to certain of Franke's figures, and therefore give some idea of what he means by abnormality in the jaws.

The point to be noted here is that Professor Brash finds the deductions from Franke's statistics to be reconcilable with his results from the study of the normal growth of the jaws.

To sum up then, so far as the first point mentioned, namely the part played in the eruption of the teeth by bone growth, as shown in the walls and floors of the alveoli, the theoretical assumption of this fact by previous writers on this subject has been experimentally demonstrated and may reasonably be accepted as a proved factor in eruption, without in the least suggesting that it is the sole factor to be considered. With regard to the second point dealt with, namely the nature and extent of the changes which take place in the jaws during the replacement of the temporary teeth by their ten anterior successors, that the reduction in length of the mid-alveolar line shown by Franke's measurements can only be due to a forward movement of the base from which the height of the arch was measured caused by forward movement of the first permanent molar in harmony with the downward and outward growth of the whole alveolar process in the maxillæ by the upward and forward growth of the alveolar process in the mandible due to growth of the bone by surface deposition, and that the discrepancy between the shortening in maxilla and mandible shown in the greater reduction in length of the lower mid-alveolar line (it will be remembered that it was 2.0 m.m. in the upper as compared with 4.1 m.m. in the lower) may be due partly to a greater advance in the lower permanent molars rendered possible by the lesser aggregate measurement of the lower successional teeth as compared to the upper, and partly by a general forward movement of the mandible due to growth in the region of the temporo-mandibular joint, which would tend to compensate for the greater flattening of the arch in the lower, and thus in normal cases maintain the correct occlusal relation of the teeth. That with regard to the third point, namely the average figures resulting from the measurements of the growth in the three directions of length, breadth and height, of normal and abnormal jaws, the fact that there was not that actual disparity in the amount of growth between the normal and abnormal as was so frequently assumed; that the increased height of the palate in certain abnormal conditions was not the product of mechanical forces acting at comparatively late periods of growth, but was more probably to be ascribed to developmental causes which were apparent in early stages of growth, and that such orthodontic difficulties as were due to narrow jaws and deformities such as the contracted or the saddle-shaped arch, might be the result of fairly normal increments of growth of the alveolar processes associated with slight deviation from the normal alveolo-palatal angle.

It would be as great an error on one side of the problem of

orthodontic practice, and contrary to all sane orthodontic experience, to suggest that these developmental errors, weaknesses or aberrations of growth, are not susceptible of remedial treatment. This would, we say, be as great an error as it would be to accept the extreme mechanical view of the dental universe as embodied in Wolff's "Elaboration of the Law of Orthogonality." For Oppenheim's experiments, as referred to in the first part of this paper, show that appropriate stimuli of pressure and tension call forth in the formative elements of the alveolar tissue appropriate response, and that within certain well-defined limits and acting in accordance with certain ascertained rules, the orthodontist may intervene with benefit to the organism in limiting and it may be even destroying the bad effects of developmental weakness or error. But while the effects of these errors will continue to present themselves in dental practice, while even without postulating such errors, the extraordinary mixtures of brachy and dolico facial types and the vagaries due to dominant and recessive elements in a system of race perpetuation such as that of our own, where eugenics do not exist, will continue to supply material for the exercise of the mental ingenuity and manual dexterity of orthodontists, yet we would suggest that these matters we have been dealing with, and indeed all the other important contributions to this engrossing subject (such as those by Sir Arthur Keith and Mr. G. G. Campion, Professor Arthur Thomson, Professor Fawcett and Mr. Northcroft, and the presidential address to which we listened a few weeks ago) seem to point away from many of the mechanical obsessions of an earlier orthodontic day, from adenoids, mouth-breathing, imperfect mastication, and muscle pressure, as the cause of many of these abnormalities, to a deeper and earlier cause, and to suggest that orthodontics will follow the tendency of dental surgery generally by laying increasing emphasis on the preventive aspect of the science.

DISCUSSION.

The PRESIDENT said the applause accorded to the authors would convince them of the wisdom of the task they had undertaken. They had undertaken a very big work in collating the writings of so many authors, writings which, moreover, took a good deal of reading and understanding. It would be satisfactory to the members to know that their efforts as orthodontists were not entirely vain.

Mr. W. H. DOLAMORE said that in a measure he was responsible for asking Professor Brash to give the lectures to which the authors had alluded. The idea was that the knowledge already gained on the subject should be summarised, so that the position already reached should be made clear. Professor Brash had only relatively short notice, and it was rather wonderful that he should have been able to accomplish so much in the time. It should be borne in mind that the main lesson which Professor Brash desired to point out was that there were three or four methods by which the subject might be approached—by measurements, by experiments, and by observation. Unfortunately it was not possible to feed human beings with madder, but it was possible to watch them and take models of their jaws at different age periods, so that the growth of the jaws could be watched. In that way further facts might be obtained. The amount of information at present available was very limited when one came to sum it up. He desired to thank the authors for their wonderfully interesting paper.

Mr. A. C. LOCKETT said the authors had shown certain microscopical

changes that were taking place in the bone as a result of tooth movement and lingual pressure. The slide demonstrated clearly that there were different formations in the actual alveolar bone, but he would like to ask the authors what the character of that bone was, or what it looked like microscopically, at a period of three to five years after the case had been treated, when the bone might have had an opportunity of assuming what might be regarded as its final form. He was anxious to know what the character of the bone was four or five years after the force had been removed. Was it normal, or of a different character to what one would expect to find?

Mrs. LINDSAY said it was normal, but much thicker.

Mr. LOCKETT asked if it were less cancellated.

Mrs. LINDSAY said she could give no information as to what it was like five years afterwards, but six months afterwards on the labial side it was compact bone and on the lingual side it was cancellous bone, but thicker.

Mr. LOCKETT thought if it took that form in six months it would probably be about the same in five years. At any rate, it was to be hoped it would.

Dr. J. SIM WALLACE said he had seen Franke's book, and the general and ultimate conclusion was that the only thing that accounted for narrow arches was lack of mastication. He believed the writer of the review in the *British Medical Journal* had also pointed out that as Franke's conclusion. He would like to know if that was correct, and whether Franke had really come to the conclusion that contracted arches could not be put down to various things like mouth-breathing, and so on, and that the only thing which could be held to account for contracted arches was lack of mastication. He would not have mentioned the point but for the fact that there was some applause when a reference was made to the mastication theory being knocked out altogether by Franke's brilliant discoveries—which, as a matter of fact, were as wrong as they possibly could be in almost every respect. Not only did Franke not know that the jaw moved forward, but he did not even take measurements where it did not suit his purpose. That the jaw moved forward between the premolar teeth had been shown over and over again, but Franke made his arches with those two teeth remaining stationary and the molars going broadways and the incisors coming backwards, not recognising that the molars went forward and that the permanent incisors occupied exactly the position of the temporary teeth that preceded them on the alveolar arch.

Mr. J. H. BADCOCK said he was lost in admiration of the paper, the work it had entailed and the very able and brilliant way in which it had been put forward.

Sir HARRY BALDWIN said he did not agree at all with what Mr. Dolamore had said with regard to edentulous arches never showing any irregularity. Personally, he had seen scores of them which showed great irregularity in the direction of diminution—which were too small. His own opinion was that the chief thing which accounted for irregularities of the teeth was diminution in size or compression at the sides of the jaw, and he felt strongly that that was due very largely to lack of some developed dental stimulus occurring very early in life—probably something in connection with feeding. If that were so, it pointed to the desirability of undertaking regulation work, if it were to be in the direction of expansion, as early as possible, when some development must still be going on. It also showed the necessity in later cases of relying more on extraction. He believed if half the cases of contracted arch were taken in hand round about the age of 12 or later they would almost certainly go back to a bad position, perhaps not so bad as, but something like, the original position, if room was not made by extraction. He thought that if a very small child were fed on absolutely soft food continuously, until it was fully developed into an adult, so long as the food was perfectly fitted to the

requirements of the body in its essential constituents, quite apart from any question of mastication, very likely the jaws would develop perfectly; there might not be any contraction at all. If that were so, it was a very helpful aspect in regard to the prevention of such troubles, which must depend simply on scientific feeding.

Mr. W. A. BULLEID said that when listening to the paper and discussion, as well as to discussions of a similar character, it occurred to him that there was perhaps a tendency on the part of members to look for a cause of under-developed or abnormally developed jaws. He thought that was adopting a wrong line; it was necessary to look for causes. He could think of at least three factors which were involved in the development of a bone. There was, in the first place, the inherent hard growth which every bone possessed. If conditions were favourable, the bone would grow to the predestined form that the demands of the animal required. Then there was the question of function. Superimposed on the inherent power of growth was function. If function were normal, if a bone were used as nature intended it to be used, if, in the case of the jaw, mastication were carried on as nature intended it to be carried on, all would go well. The third factor, which was also a post-natal one, was that of disease—disease in the bone or, in particular, in other parts of the body. He was thinking, of course, of the derangement of the endocrine glands. All those factors must be taken into consideration, and they could be permuted and combined in different ways, and as a result an abnormal bone might be produced. Therefore, though he could not discuss the paper in detail without having an opportunity of reading through it carefully first, he felt that in approaching the subject one had to bear in mind that the question was not a simple one, and that in a complex thing like the development of a human being throughout his life one would not find one single cause operating. He fully agreed, therefore, with Mr. Dolamore in thinking that the inductive, experimental method was the only sound one by which to approach the subject.

Mr. GEORGE NORTHCROFT expressed his admiration for the interesting paper the authors had presented, which would help on the advancement of knowledge with regard to the very difficult and abstruse subject with which it dealt. Ideas on the matter were, he thought, being oriented along the correct lines, and such criticisms as had been expressed that evening would merely tend to make people move forward with due caution and not jump too readily to conclusions. Up to now it was his firm conviction that people had been jumping to conclusions too readily, and laying far too great stress on mechanical causes as producing irregularities of the teeth and jaws. Personally, he thought most of the irregularities which occurred—other than the extremely simple and obvious ones—were due to causes which were deep-lying and for the most part mental in their nature.

Mr. ROBERT LINDSAY said he agreed with Mr. Dolamore as to the value of Professor Brash's lectures. In fact, it was their conviction of the value of those lectures which set the authors to study them carefully. A whole session could be spent in discussing points arising out of those lectures, but the authors could only select one or two which specially appealed to them. A point to be remembered when reading the lectures and when discussing Franke's experiment and statistics was that Franke only professed to give average results. When considering his measurements and his cases, that must always be borne in mind. These results were particularly open to the remark Mr. Dolamore had made, and which, indeed, had been made by Franke himself—that he had to depend on museum specimens, and that therefore a large amount of his material was, in some way or another, abnormal. Still, it must be remembered that Professor Brash, examining those statistics and applying them by ingenious plottings and diagrams to the test of his experimental work, found that they were not necessarily antagonistic. Probably that was as far as

Professor Brash was prepared to go, and he was sure it was as far as anyone at present would be prepared to go. Mr. Lockett asked what was the character of the bone after three or four years. Unfortunately, Oppenheim killed his baboon after six months' experiments, and so what was shown on the screen could only be the results after six months. In his retention experiments, the record of which formed a very interesting paper following on that from which the authors had taken their photographs, he gave some results over a slightly extended interval of time, showing the condition of the bone at that period. He wished to direct Dr. Sim Wallace's attention to the fact that the abnormalities discovered by Franke and commented upon by Professor Brash could hardly be greatly due to lack of mastication, because what they brought out was that the abnormalities were present from a very early age indeed, and before the age of 2 it was not very likely that mastication would have much effect on changes in the jaws. No one would ever think of dismissing all the influences which had been referred to as having an effect upon the subsequent development of abnormal jaws, but what was suggested was that probably in the past people had been in the habit of putting too much reliance upon obvious mechanical factors. He thought that also answered Sir Harry Baldwin's point, because the whole tendency of the lectures was to show a developmental cause. Mr. Bulleid was quite right in saying it was not a cause, but causes. Mrs. Lindsay, in opening her paper, used the word "causes" as a precautionary measure. The authors certainly did not intend to suggest that there was any particular nostrum which was responsible for the abnormalities in question in the jaws, but were inclined to feel, both from reading Professor Brash's lectures and from reading other material tending in the same direction, as well as from what they had been able to extract from Franke's work by translation, that something was to be obtained from the remarkable statistics and careful and elaborate plottings which Franke gave. Franke had the German capacity for going into that kind of thing in a detailed manner which was almost appalling to think of, but the results of his work (which extended over twenty-five years) could not be ignored. With regard to the dominating factor in the question of normality and abnormality, he was reminded of the opinion of Sir Thomas Clouston, who, long ago, wrote the following interesting and important words: "Looking to the dominant influence of nerve over nutrition, it seems reasonable to attribute even early formative failures and malformations of body and limbs to some degree of deficient trophic innervation."

The PRESIDENT proposed a hearty vote of thanks to the authors for their paper. This was carried by acclamation.

THE DEVELOPMENT OF THE GUMS AND THEIR RELATIONSHIP TO THE DECIDUOUS TEETH IN THE HUMAN FŒTUS.

By DR. C. M. WEST.

An abstract from "Publication No. 79" of the "Contributions to Embryology," published by the Carnegie Institution of Washington, to whom those interested are referred.

THE gum may be considered as consisting of two separate parts in the adult, a labio-buccal and a lingual portion, which are developmentally distinct.

The two parts of the gum differ from one another in several respects. The labio-buccal portion is the first to be developed; it grows more rapidly and to a greater extent and forms a larger part of the definitive gum; it early becomes divided into segments

which correspond in number with the deciduous teeth and the surfaces of these segments become rough, nodular and ultimately papillomatous and occasionally free villi may be seen upon them. The lingual portion of the gum, on the other hand, develops later, does not grow to such an extent, forms a smaller part of the adult gum, is not divided up into segments and remains entirely smooth.

The two parts of the gum can be well seen in a foetus of 78.5 mm., in which it is evident that the labio-buccal and lingual portions are marked off by three grooves—the labial or lip groove, which limits the labio-buccal portion of the gum on its superficial aspect, and the dental groove, which gives rise to the enamel organs of the teeth and, limiting the labio-buccal portion on its deep aspect, separates it from the lingual portion which, in its turn, is separated from the palate by the gingival groove. The dental groove, in the incisor region, runs parallel with the periphery of the gum, but as it is traced backwards it passes obliquely across the gum in a lateral direction to join the labial groove in the molar region; it thus comes about that the labio-buccal portion of the gum becomes progressively smaller as it is traced backwards, while the lingual portion becomes larger. When the teeth come to erupt the two incisors and the canine pass through the labio-buccal portion of the gum, while the molars erupt partly through the labio-buccal and partly through the lingual portion; thus the final sheath of the erupted tooth in the incisor and canine region is formed entirely by the labio-buccal portion, and in the molar region both parts of the gum take a share in its formation.

The labio-buccal portion of the gum is divided into segments. The first indication of this may be seen in a foetus of 90 mm., and from this time on the segmentation increases till just before term, the segments being best marked about the eighth month, and they may even be developed to such an extent as to simulate newly erupted teeth (Figs. 1 and 2). This resemblance is made the more striking by the fact that the distal portions of the segments appear blanched in comparison with the more proximal part. Explanation of this white appearance is found on examining the structure of the segments of the gum, when it is found that at the periphery they are hard, firm and comparatively non-vascular, whereas near the crown of the erupting tooth the tissue of the gum is much looser in texture and contains large numbers of capillaries. This condition advances in front of the developing tooth and would appear to be of some assistance in its eruption, for the looseness would tend to diminish the resistance it would have to overcome on its way to the surface, while the large number of capillaries would furnish material for the nutrition of the developing tooth.

The segments of the gum correspond in number and position to the deciduous tooth sacs and they may be named in accordance with these structures as medial and lateral incisor, canine and first and second molar segments. The medial incisor and canine segments are about equal in size; the first molar is the largest and the lateral incisor the smallest, with the exception of the last molar, which, owing to the small size of the labio-buccal portion of the gum in its neighbourhood, is frequently difficult to recognise.

By removing all the bony and cartilaginous portions of the maxilla it is possible to show the tooth sacs, and from an early stage it is seen that the lateral incisor tooth sac does not lie in the same curve with its neighbours, but occupies a much more posterior position, being placed nearer the palate (Fig 3). This backward position of the tooth sac is accompanied by a rotation of the enclosed tooth, which thus comes to present one of its edges to the front, either the medial or the lateral, according to the direction in which the rotation has taken place; this position of the tooth sac is also correlated with the small size of the lateral incisor segment of the gum.

Until about the twenty-first week the surfaces of the segments of the gum are smooth, but from this time on they begin to grow rough with small nodules, which later develop into papillæ, and the condition may progress so far as to give rise to free villi on the gum. This appearance of nodules on the gum is synchronous with the commencement of villi on the lips, the two conditions developing *puri passu*, the growth of the villi, however, always being somewhat in advance of the papillæ on the gum. In this connection it is perhaps worth noticing that the villi so well seen on the lips do not appear first in this situation but at the posterior part of the cheek, in close relationship to the tonsil.

As regards the function of the segments of the gums, they must be considered as portions of the gums lying in relation to the tooth sacs and specially set apart to assist in the nutrition and eruption of the developing tooth. It has already been stated that the tissue of the gum around the crown of the tooth is highly vascular, as may be very beautifully demonstrated by injecting the vessels with india ink. In such preparations it is found that all the vessels appear to come to an end at the outer layer of the enamel epithelium, and the stellate reticulum appears entirely non-vascular. By microscopic examination, however, it can be shown that here and there capillaries do penetrate the outer layer of the enamel epithelium and run for a short distance in the stellate reticulum. This does not seem to be the usual method of termination of the capillaries of the tooth sac, and one is led to believe that the stellate reticulum must have some power of transporting from the vessels to the tooth the materials required for its nutrition and amelogenesis.

DISCUSSION.

The PRESIDENT said the lecture was one of absorbing interest. Dr. West had presented slides such as had not been seen before and the photographs of sections were certainly to be admired and wondered at. There were some actual specimens present which were too delicate to be handed round the room, but every member should try and see them because they showed how faithfully the photographs had been reproduced.

Prof. WRIGHT said it was not by any means a formal tribute when he said that he had listened to the lecture and demonstration with as much interest as he had listened to any lecture or demonstration on any anatomical subject. It had impressed him as being of very great utility, particularly to orthodontists, and it was interesting not merely in its minutiae but also in what might be called its philosophical aspect. It was generally accepted now that, as there were wheels within wheels, there were skulls within skulls, and it was accepted that man had not merely his own skull but in its interior an ancestral skull now repre-

sented very largely by the *dura mater*. That was a theory, for example, which explained why the fifth nerve went through a foramen in the *dura mater* prior to going through the foramina of the skull. If there were skulls within skulls it might be expected that there would be jaws within jaws. In the lower jaw, for instance, there was Meckel's cartilage, which was no doubt the primitive lower jaw, and in the upper jaw, less easily recognised, there was the pterygo-palatine bar; so that just as there was an earlier cranium and a later cranium there were earlier and later jaws. If that was the case with regard to the jaws it might well be the case with regard to the teeth and it might be that there was an ancestral dental lamina, and that on the outside of this was developed a new dental lamina which became the functional lamina. What had impressed him very much was the separation between the lingual and the labial portions of the gum, and he would suggest to Dr. West that he might find that the lingual portion of the gum was a relic of the tooth-bearing portion of the earlier jaw, and that the labial portion had been added at a later period on the outer side. In the specimens shown the lingual portion seemed to be very distinctly separate from the other and the groove between them struck him as being very remarkable. He recalled the time when he worked at the problem of the morphology of the skull, and how he had then noticed a very interesting fact, viz. the presence in one of the most ancient of fish, *Lepidosteus*, of two rows of teeth in the case of each jaw, one row inside the other. Such an explanation as that which he was now suggesting was the only theory he could advance to explain the curious separation of the gum into two parts as demonstrated by Dr. West. The villi in the interior of the mouth had also interested him for a long time; they could be seen particularly well marked in the mouth of the sheep. They seemed to serve the purpose of a tooth-brush or, as had been suggested by Prof. F. Wood-Jones, of the University of Adelaide, of tooth-picks. He imagined they were very movable, in a tentacle-like fashion. The villi would appear to aid the cheeks in cleansing the buccal surfaces of the teeth as the tongue cleansed the lingual surfaces. The part played by the tongue in keeping the teeth clean, it might be of interest to mention, was remarked some four hundred years ago by Leonardo da Vinci. He had sometimes thought that when the ideal tooth-brush was discovered—and he looked to the dental profession to devise it—it would be on the lines of such soft plastic substances as the tongue and the cheek with its villi. With regard to the segmentation of the labio-buccal (dental) portion of the gum, while he was familiar with the appearance in the undissected gum, he had never had the bright idea of making dissections in the way Dr. West had made them, and he thought Dr. West had put the whole dental profession under a very great debt by the beautiful specimens which he had shown. They were both beautiful and clear and spoke for themselves. The references made to the lateral incisor were very interesting because the lateral incisors were the key teeth, it seemed to him, in orthodontics. These teeth developed in the intermaxillary suture—he thought Sir Arthur Keith made that quite clear—not so much on the premaxillary side or the maxillary side as actually in the suture. That explained why in cleft palate the line of cleavage did not by any means invariably pass between the lateral incisor and the canine teeth. In fact, as Sir Arthur Keith has pointed out, the cleft is more frequently between the central and lateral incisors than between the lateral incisors and canines (twenty-three cases as against nine) suggesting that in the struggle for the lateral incisor, lying so to speak in no man's land, the maxillary portion of the alveolar process was usually the victor. The region of the intermaxillary suture was in his opinion a very unstable and variable region. Those who had studied the dentition of the insectivora would appreciate this statement, for in these animals the intermaxillary suture is sometimes in front, sometimes behind and sometimes actually

occupied by what from its general appearance is usually regarded to be the canine tooth. The lateral incisor seemed to him to be one of the teeth in the dentition of man which was frequently subjected to a great amount of strain; it was very frequently displaced and not infrequently absent or small. A good deal of attention, he thought, should be paid to the lateral incisor in orthodontic work. There was quite a number of things in the paper which had interested him, one being the problem of how the vessels got into the enamel organ. His friend Prof. Frazer might perhaps have something to say on that. There was no doubt that from the specimens shown the vessels were in the enamel organs, but the cells which produced them it would seem had migrated into them. He was inclined to think that there was no evidence of blood vessels appearing in an epithelial organ except as a result of migration.

Prof. FRAZER said the paper was an excellent one, full of information much of which was quite new to him. He was aware of some of the structures that Dr. West had shown on the screen and particularly those flap-like growths of the outer part, because they were figured by Carl Peter many years ago. They could be seen certainly as far back as the end of the third month. Not only were they visible on the surface of the gum after the third month, but they could be also found in the third month and back to the end of the second, but they were buried under the epithelium of the labio-dental furrow. In earlier stages still, in embryos between 15 and 20 millimetres long, they were not apparent because there was no formation of the furrow, and in that stage the layer of thickened epithelium was only on the surface, but after 20 millimetres there was the so-called "sinking" of the line of epithelium and with that began to appear the labial surface of the gum. That was associated with the so-called sinking of the dental ridge into the gum. There was no sinking of the ridge in the sense that it grew into the gum. There might be a little sinking first of all, but as soon as the ridge opened out and made a commencing enamel organ the sinking stopped, and had to stop. The free edges of the thin laminae of epithelium might extend into the dental papillae, but the ridge as a whole, with its enamel organs, could not sink. That could be proved by the relations of the organs. It could be proved that in the upper jaw the positions of the enamel organs were constant from the beginning; the nerves, for example, kept the same constant relation. If the organs grew down in the lower jaw the teeth and Meckel's cartilage would sink at the same time through the jaw, which was of course absurd. What really happened was that the gums grew up on either side. The alveolus is formed deep to the bases of the upgrowing gums. Taking the upper jaw, for example, the early bone formation of the upper jaw lies along the upper and outer side of the tooth germs; it does not come down on the outer side nor for some weeks on the inner side. It extends across between them a little later; more particularly between the canine and the first molar, but it does not grow down on their outer side; in other words, those organs are not embedded in bone; they are growing organs, very small and growing very slowly, and if they were ringed round with bone they could not grow. If the whole thing was reconstructed it would be found that on each side of each enamel organ there was an upstanding mesenchymal ridge. The segmented appearance came in very early, but all was buried below the epithelium. That was the condition of things up to the third month. So far as the gum on the inner side was concerned in the early conditions there was a very marked swelling on the inner side of the ridge which had sometimes been called the alveolar portion of the maxillary process, and there was a ridge left on the inner side. It was not a matter he had followed very closely, but he should like to ask Dr. West if he had paid any attention to the transverse palatine ridges which showed up so well in some of the specimens. He did

not think anything was known about them. They seemed to be connected with teeth and were present in all animals and appeared to correspond with the intervals between the teeth. There were some other points that arose in regard to the matter, first of all the case of the lateral incisor, a tooth which from the beginning lay behind the situation of the central incisor. He thought the situation led to what some of the photographs showed very well, that the tooth behind was pushed forward to the front of it. He thought it depended on the relative rates of growth of the maxillary process and the extension of this process over the fronto-nasal process. He thought the relative rates of growth accounted for the difference shown in some of the photographs. The central incisor was the one tooth which was not free from bone in the early stages, but he did not know why. The lateral incisor was formed from a rudiment placed on the junction between the two processes, and that rudiment might not only get pulled to one or other side, but might find no junction, and so have to grow between the processes: or the rudiment might be split secondarily into several parts, and there might be even half a dozen "pre-canines" all representing what should be one normal lateral incisor. Those, however, were pathological conditions which did not affect the points that Dr. West had brought out.

Dr. GLADSTONE said he very much appreciated the very clear demonstration of very difficult work, and work which he believed to be quite new.

Mr. PITTS asked whether in the course of his investigations Dr. West had found any evidence of the double origin of the enamel organ as put forward by Bock. He remembered reading three or four years ago a paper in which Bock described some of the segments which Dr. West had described, but his memory was not sufficiently good to say whether that writer agreed with Dr. West. He had been exceedingly interested in what Dr. West had to say about the papilla on the lips, because for some years past he had been much intrigued by noticing that if the lip was pulled up, in a very large number of cases it was possible to see a little tiny papilla projecting from the free edge of the frænum of the upper lip, and he wondered whether it had any morphological significance. He suggested that possibly it might be the remains of one of the villi which Dr. West had described. Some members would no doubt remember a very interesting paper read by Dr. Sonntag at the Odontological Section of the Royal Society of Medicine, in which he showed how very numerous the papillæ on the palate were in many animals, and stated that there was an inverse ratio between the complexity of the papillæ in the mouth and the digestive apparatus, and that they played a considerable part in digestion. It was often noticed that instead of getting well-defined rugæ, if one took a plaster impression, one would notice they were split up into a mass of small nodules very much as was shown in the sections. He had been much interested in the demonstration of the blood vessels in the enamel organs. It appeared to be conclusively proved that they did penetrate into the enamel organs in some animals, and there seemed to be some evidence that they did so in human beings, and the paper brought the matter a little further forward. It was a paper of very considerable interest and one which should be of great value.

Mr. G. NORTHCROFT had the privilege of seeing some of Dr. West's specimens when he was over in Dublin, and the thing that interested him most as an orthodontist was the position of the upper lateral tooth sacs. It had been so often said in the past that the irregularity of those teeth arose later on in life and was due to a condition such as mouth breathing or some mechanical cause, whereas it had been conclusively shown that evening that the position of those teeth was developmental, and that later on it was some lack of co-ordination between the growing parts which left those teeth in their developmental

position, rather than moving into those positions which we consider normal later on in life. A point brought out very clearly was that in front of the lateral incisors there was a thickly developed plate of bone which might readily account for the persistence of the position of the teeth later. Another interesting point referred to by Dr. West was that the lateral incisors were rotated in their crypts as well as being displaced backwards. Orthodontists often noticed the medial rotation of upper lateral incisors, the medial angle being turned towards the lip; this was a persistence of their developmental position and not caused by any mechanical pressure or external cause.

Mr. C. SCHELLING asked Dr. West whether he had any doubts as to the existence of babies having been born with teeth? If he had any doubts he could say that he himself had a case which he described some years ago at the Odontological Society, and he had the teeth and a model of the jaw in his possession at the present moment. With regard to the villi, he remembered on two occasions seeing cases of middle-aged men where there was in the mouth a small round area with a surface resembling that of the dorsum of the tongue, once behind the second lower bicuspid, and in another case villi resembling a bunch of spring onions growing on the mucous membrane exactly on the distal-lingual side of the lower left wisdom tooth. These abnormalities were removed on the ground that they might be malignant, but they might possibly have been perfectly harmless tissues which had persisted from early infancy.

Mr. R. LINDSAY said that with reference to the situation of the developing lateral incisors he presumed it might be taken that the specimens from which the illustrations were made were all taken from infants developed under modern conditions, and it would be interesting to ascertain whether specimens from more primitive races would show the same position of the lateral incisors. This might indicate that modern conditions were, to some extent, responsible for the very marked displacement of the lateral incisor from the line of the arch. It was to be hoped that textbooks and lectures on dental anatomy would now make available for students in this country the developmental conditions shown in Dr. West's specimens. There were in the library of the British Dental Association American text books with illustrations somewhat similar to those that had been shown that evening. One thing that had struck him in looking at the illustrations was the comparatively large bulk of the segments. The tooth buds also seemed to be very well spaced. He thought that what they had seen that night, particularly what Mr. Northcroft had drawn attention to, would recall facts which had been impressed upon the mind by the President and by other contributors to the *Transactions* of the Society, namely, that the interest of orthodontists lay very far back indeed, and tended more towards the maintaining of an orderly development in the extreme youth of the individual than in the correction of complications which were found later on.

The PRESIDENT said that one point had not been referred to which was perhaps of orthodontic interest, and that was the fact that Dr. West said that the segments for the central incisor should unite after a certain period. Dr. West had explained that the frænum was present and disappeared from between the teeth. It seemed, therefore, that separation of the upper central incisors must be due to non-union of those segments. With regard to the point Mr. Lindsay had raised, he believed Dr. West had examined not only the jaws of white people but of negroes as well.

Dr. WEST, in reply, thanked the members for the kind manner in which they had received his communication, and especially those who had come to the meeting, like Prof. Wright, Prof. Frazer and Dr. Gladstone, to add to the discussion. He had been very interested in what Dr. Wright had said. He did not know that he should get an opportunity of examining the *Lepidosteus*, but if he had that oppor-

tunity he would make the examination. What had been said about the intermaxillary suture had not struck him before, but after what Prof. Wright had said it seemed quite clear that the intermaxillary suture did affect the position of the lateral incisor. With reference to the blood vessels in the enamel organs, two workers in America had been investigating that subject, working on the molar teeth of albino rats. They first of all both agreed that there were no signs of vascular perforation, but in a later paper one of them stated that he had definite evidence of vessels passing through to the epithelium. He was much indebted to Prof. Frazer for carrying the subject considerably further back. He had not realised that segments of the gum could be found at such an early stage. He had not studied the transverse palatine ridges, but he believed they might have something to do with mastication. It seemed to him to be a good rough surface for the tongue to move against in helping to chew food. With regard to Mr. Pitts's question as to whether he had anything to say about the double origin of the enamel organ, he was afraid he had not. He was interested in what Mr. Pitts said about the frænum. It was quite common to get a lateral frænum. There was also one frequently on the other side of the canine segment separating it from the lateral incisor. As to Mr. Schelling's question as to whether he had any doubt that babies had been born with erupted teeth, he was bound to say that he had some doubt, but after what Mr. Schelling had said he had no doubt whatever! With regard to the appearances resembling villi, it was in the region of the wisdom tooth, and rather behind, that the villi first appeared, and they generally disappeared during the first week after birth. It was in that region that the villi took the longest time to disappear. They became thread-like but they could be still found in that position some time after they had disappeared from the lips. As to Mr. Lindsay's question, he had examined both negro and white specimens. He did not know whether the American negro was considered to be less a modern specimen than white, but he was not far behind.

Votes of thanks having been accorded to Miss Smyth and Dr. West for their communications, the Society adjourned.

THE TEETH OF NEW ZEALANDERS.

By LINDO LEVIEN, L.D.S.

THE models which I am placing before you this evening are from impressions of the mouths of fifteen of the New Zealand "All Blacks" Rugger football team. The reason of my showing them is to contradict a previous paper, which set out to prove that the mouths of the white New Zealand born had deteriorated in comparison with the natives or Maoris.† I took these impressions because, having spent a number of years in New Zealand, I was convinced that the statement was misleading. Although these men are what one calls good physical examples of the race, they are a true type of New Zealand born men, and you will see this class of men in all parts of the country, as the team comprises men of all classes and conditions. Some are sheep farmers, and others are employed in commercial and government offices in the towns. I am sure that the typical New Zealander has just as sound a mouth and dentition as his grandfather or great-grandfather, who came in the early days either from England, Scotland or Ireland, a fact

† Paper by Violet George, L.D.S., in 1924 B.S.S.O. Report, page 70.

THE DEVELOPMENT OF THE
GUMS AND THEIR RELATIONSHIP TO THE DECIDU-
OUS TEETH IN THE HUMAN
FŒTUS.

FIG. 1.
Palate of fœtus of 29 weeks seen from below, showing the lingual portion and the segmented labio-buccal portion of the gum. (a) Dental groove, (b) gingival groove. The numerals correspond to the segments of the gum $\times 2$.

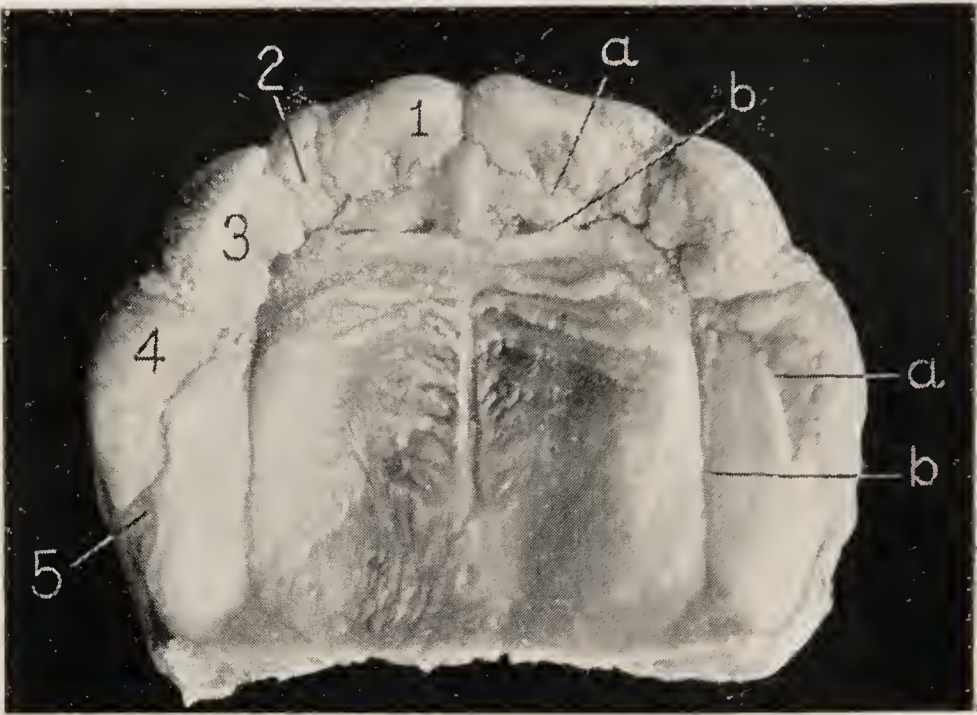
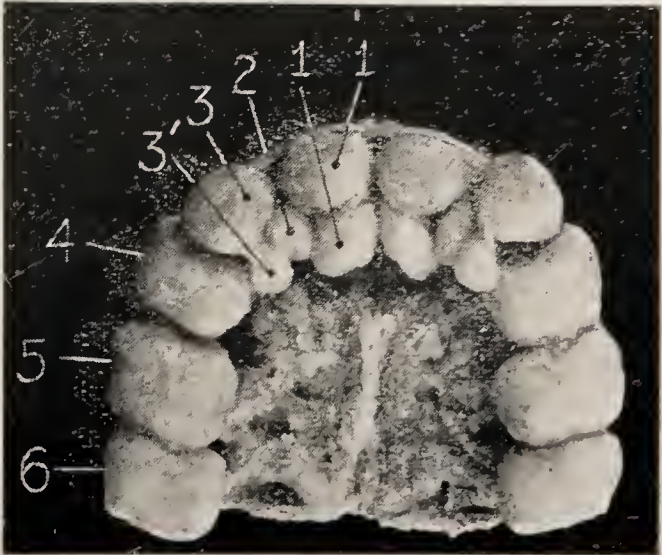
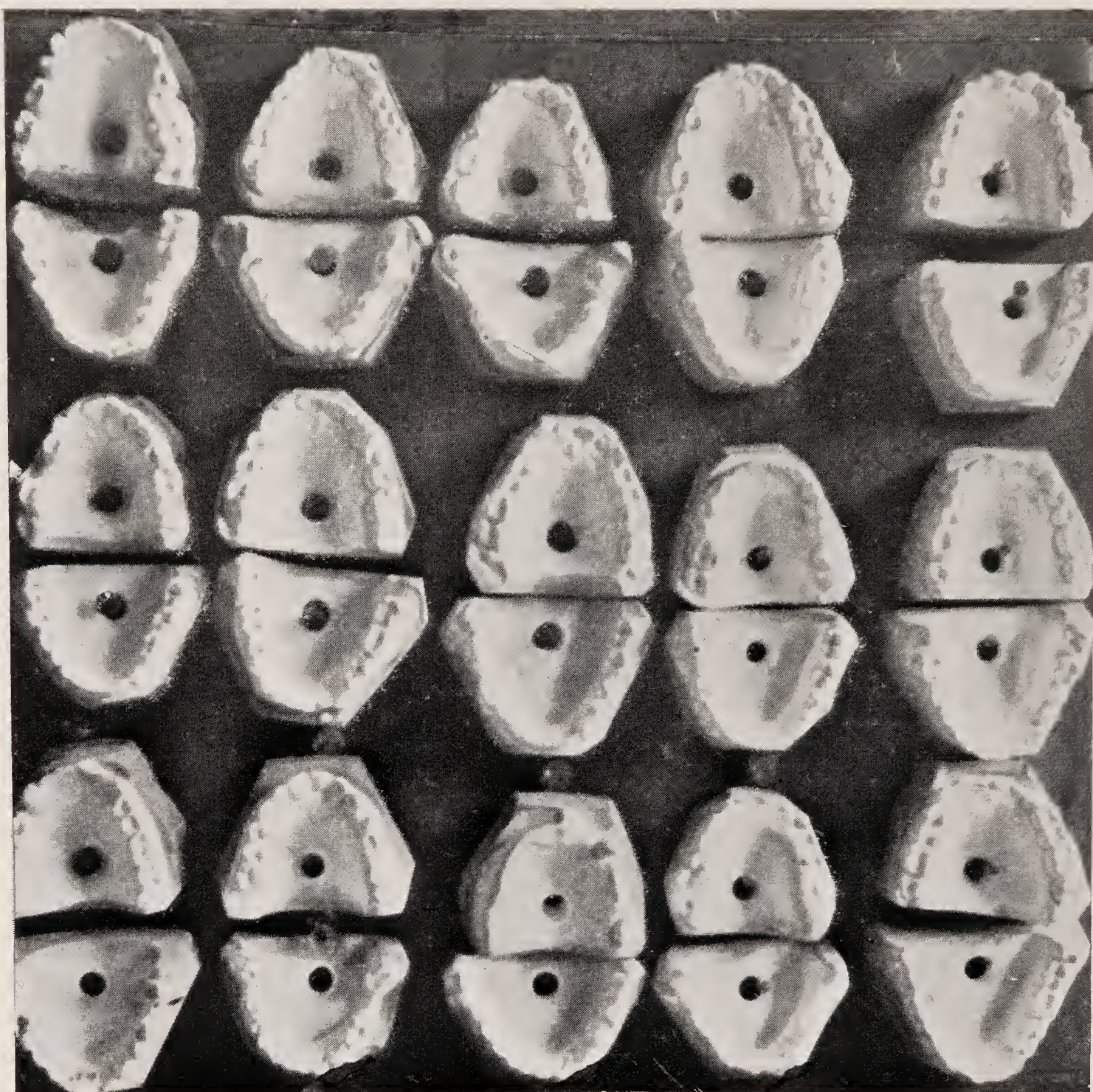


FIG. 2.
Face of a fœtus of 31 weeks, showing the similarity of the segmented gum to newly erupted teeth $\times 3$

FIG. 3.
Upper surface of the palate of a fœtus at term, showing the positions of the tooth sacs. (1) Temporary medial incisor, (1') Permanent medial incisor, (2) Temporary lateral incisor, (3 and 3') Temporary and permanent canines, (4 and 5) Temporary first and second molars, (6) First permanent molar.



THE TEETH OF NEW ZEALANDERS.



Illustrating Mr. LINDO LEVIENS Communications.

which we are rather apt to overlook. It is the recognition that these models are broadly typical of a whole people that enhances the pleasure I have in placing them before you, and in handing them over to the Society.

DISCUSSION.

The PRESIDENT said Mr. Levien had given the Society a communication of both sporting and scientific interest. He had certainly vindicated the honour of New Zealand so far as the arches of the "All Blacks" were concerned.

Miss V. H. GEORGE thanked Mr. Levien for the trouble he had taken in preparing his communication. He was, however, under a misapprehension, since she had never intended to convey the impression that the whole of the New Zealand people had contracted arches. All she had done was to compare two sets of arches. She did not know where the models she showed had come from; Mr. Levien suggested they were from a late contingent of the Army, and possibly that was so; they might be from men of the "C3" class. Mr. Levien's communication had demonstrated that one of her suppositions was wrong. She had said that, to judge from the contracted arches she showed, one would expect the men themselves to be of poor physique. One or two of the models in Mr. Levien's collection were not so good as the others, but if they came from Rugby players of the type shown it did suggest that small arches and large men might go together.

Sir HARRY BALDWIN said the collection of models which Mr. Levien had shown was very interesting. It would be of interest to know what sort of food the men had had from very early childhood onwards, because some of the models showed distinctly contracted arches. If contracted arches were due to an excess of unbalanced carbo-hydrates in very early childhood, it would be important to know what the food was. Probably their food was much the same as ours, and the bread and flour they had was of the extremely white variety which permeated the whole of the civilised world at the present time. Many of the models showed evidence of caries. One would expect to find caries amongst New Zealanders, just as one did in this country, because the food was similar. Professor Pickerill had said that, whereas the Maoris of a generation ago were almost immune from caries, in the course of one generation those who had adopted European foods had entirely lost that immunity, and had teeth which were just as prone to decay as ours.

Mr. LEVIEN, in reply, said with regard to Sir Harry Baldwin's remarks, the only difference between the food in New Zealand and in this country was that in the former it was always fresh and unadulterated. In the country districts the babies were usually breast-fed, but that was not so much the case in the towns. Caries was very prevalent in New Zealand; one saw more artificial dentures there than in this country.

SOME CASES OF INTEREST AMONGST L.C.C. CHILDREN.

By KATHLEEN C. SMYTH, L.D.S.

I WANT to begin with an apology for the poor models I am showing you this evening. In excuse I must plead that the impressions were taken under very unfavourable conditions. They were done in the schools, where hot water is measured out almost by the drop, and where any such operation as impression-taking is apt to be regarded with disfavour and suspicion, not only by the children

but also by the teachers! So I must ask you to be lenient. Also I am sorry the photographs are so poor. They were taken indoors and I had not sufficient experience with time-exposures.

I should like to take the opportunity of acknowledging Mr. Kelsey Fry's kindness in having one of the cases radiographed for me at Guy's Hospital.

Case I.—A boy, age 13 years 8 months. Unusually well-developed arches. Beautiful molar occlusion, on right especially. Left upper first premolar has erupted buccally to the left lower second temporary molar, and shows a marked facet on the tip of its lingual cusp, while there is a corresponding facet on the temporary molar. Spacing extremely well-marked, particularly between upper laterals, canines and first premolars and lower premolars. Yet there is distinct irregularity of the lower canines, the left especially overlapping the lateral.

Bearing in mind Dr. Sim Wallace's remarks in the discussion of Mr. Chapman's paper a few weeks ago, to the effect that he had never seen a mouth in which there was spacing when all the teeth were present, I am wondering what will happen when this boy's third molars erupt—whether the molars and premolars could possibly be pushed forward sufficiently far to close all the spaces at present in existence? There appears to be ample room behind the second molars for the third molars to erupt without any difficulty.

I took various measurements of the boy's jaws and arches, but I will not trouble you with more than three—those taken from the transmeatal axis to the gingival margin between the upper central incisors; the incisive margin of the same teeth; and gingival margin between the lower central incisors. These measurements for this boy are 94 mm., 95 mm., 94 mm. respectively. To give an idea of the unusual size of these I have taken the same measurements of seven other boys, aged between 13 and 14, selected on account of their well-developed jaws, and taken the averages. These work out at 85.1 mm., 86.7 mm., 84.1 mm. respectively. This shows a difference of 8.9, 8.3, 9.9 mm. respectively, between the figures for this boy and those for what may be taken as an average well-developed mouth in a boy of the same age. There is no striking difference in any other of the measurements which I took, though the breadth of the arches is rather large.

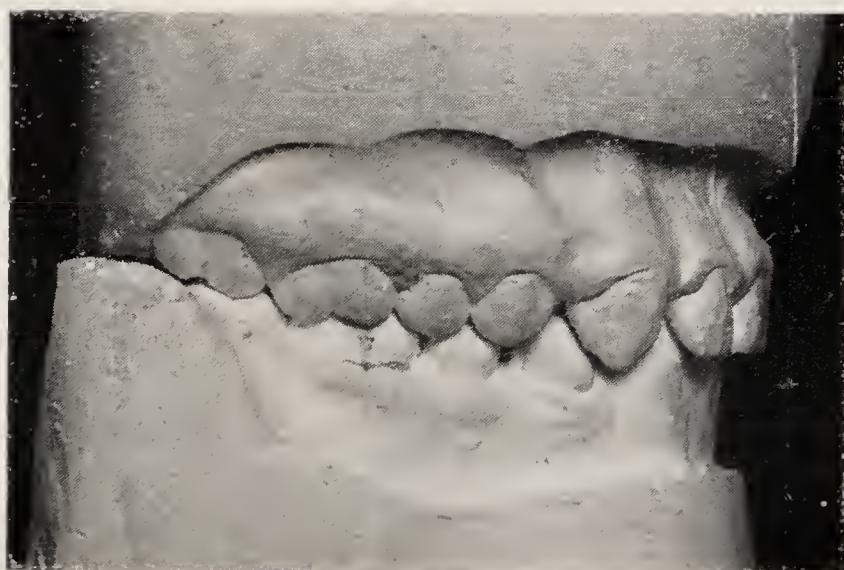
The boy's home is in Bermondsey, and his living conditions seemed to me fairly poor. It was difficult to get through the hostile attitude of his mother, but she told me that he was breast-fed for nine months, was no trouble to rear, and had never had a doctor in his life. He would eat anything he was given, did not show any special preferences, but was not fond of sweets. He cleans his teeth most days with a piece of flannel and soap.

There are eight other children, all alive and in good health. One brother is said to have a beautiful set of teeth.

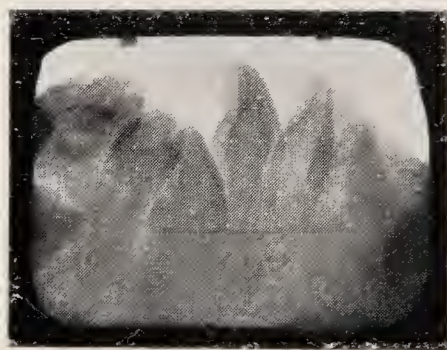
Case II.—A girl aged 10. A very large tooth in right lower lateral incisor region. Right lower central is present, rotated through a right angle; also, as shown in the film, the canine, so that presumably the tooth is the lateral, geminated with a supernumerary tooth. I should like to know whether this is a common variety of gemination or not?

SOME CASES OF INTEREST AMONGST L.C.C. CHILDREN.

Case I.



Case II.



Case III.



One other point is noticeable—the right upper central is kept at a higher level than its neighbour, by the position of the lower central upon which it bites. This tooth (the upper central) is discoloured and slightly loose and the gum around it is inflamed.

Case III.—A boy, aged 9. Marked asymmetry of face, and jaws in particular. Very noticeable when the boy speaks, which he does with a slight lisp. The vault of the palate is distinctly higher on the right than on the left. I have trimmed the models so as to give as accurate an idea as possible of the line of occlusion; it is certainly not exaggerated, but it was difficult to gauge it exactly. The depth of the horizontal ramus of the mandible on either side hardly differs at all. The whole mandible slopes, as shown in the photograph.

The mother's replies were not very enlightening. She says he was a full-term baby, no instruments being used. She cannot remember his being dropped, or having any kind of accident. He is a small, weakly-looking boy.

DISCUSSION.

Mr. GEORGE NORTHCROFT drew attention to a matter which had struck him in connection with one of the last cases shown, where the right upper central had not erupted to its full length on account of traumatic occlusion with the lower central incisor or supernumerary. He thought the case bore out very well the result of traumatic occlusion, showing the resulting inflammation and periodontal disease which was set up by traumatic occlusion.

Mr. NORMAN G. BENNETT thought the first case was particularly valuable, as it showed spacing of the teeth with extremely well-developed arches, and the teeth, although moderate in size, were small for those arches. There was a sort of idea often expressed, not only on this side of the Atlantic but more particularly on the other, that teeth and jaws were always the right size for one another. He thought orthodontists knew that they were not. While some people were willing to admit that the teeth could be too large for the jaws, they seemed reluctant to admit that there should be teeth too small for the jaws. One happened oftener than the other because the jaws grew at a greater rate than the teeth. Cases were seen where the teeth were small for the jaws and produced spacing, that spacing being either in the front of the mouth or towards the front of the mouth; it was very rare between molars. He hoped members would bring forward similar cases in order that the records might be ample.

Mr. S. FRIEL said the first case had interested him most because in cases of normal occlusion he had seen none with perfectly straight teeth that had not spacing, and as far as he could gather it was essential to have a spacing between the central and lateral in order to have the teeth in an even row. Where the teeth were all touching there was a little crowding in the incisor region. That had been his experience, although he might not have examined enough cases to be dogmatic.

Mr. PITTS said he had been interested in the second case because he thought the fusion of teeth in the permanent dentition was very rare. He saw quite a number of such cases in the deciduous dentition, usually the fusion of the lower canine and lateral, and not infrequently what must be regarded as either fusion of one of the temporary teeth with a supernumerary tooth or else dichotomy of a tooth-germ. He had seen a case recently in which there was, in the lower jaw on each side, fusion of the canine and lateral, and on the left side of the upper jaw also a fusion of central and lateral in the temporary dentition. He had only seen one or two cases in the permanent dentition.

Mr. MAXWELL STEPHENS recalled seeing cases of a father and son

in which the fusion of the upper central incisor with the lateral incisor was present in each.

Mr. ROBERT LINDSAY said he had been much interested in the suggestion made by Mr. Bennett as to the possibility of having small teeth and large jaws. He believed, roughly speaking, that it was possible to find a large set of teeth in a small jaw, but he was rather inclined to think that there was a developmental difficulty in connection with the matter, and someone suggested that such a thing was quite impossible and that the teeth and jaw would certainly correspond so far as their relative sizes were concerned. Perhaps it was not quite so much of a heresy as Mr. Bennett would suggest.

The PRESIDENT said, in connection with cases of the kind that had been dealt with, the Questionnaire which the Council was about to send out might be helpful to members in suggesting points about which they might inquire with regard to the histories of such cases.

Mr. W. RUSHTON said the first models showed that development might be carried almost to a vice, giving the face a very prognathous appearance. It was a question for the orthodontist whether the teeth should not be brought back, probably by judicious extraction, and so reduce the face to more comely proportions.

Miss SMYTH then thanked the members for their remarks.

AN ordinary meeting of the Society was held at 11, Chandos Street, Cavendish Square, W.1, on Monday, November 2nd, 1925, Mr. HAROLD CHAPMAN (President) occupying the chair.

The HON. SECRETARY read the minutes of the previous meeting, held on October 5th, 1925, which were confirmed and signed.

Mrs. Stirling signed the Obligation Book and was admitted to membership by the President.

A number of visitors were present; they were asked by the President to consider themselves members for the evening and invited to take part in the discussion.

The following candidates were elected to membership: Stanley A. Riddett, M.R.C.S., L.D.S.Eng., L.R.C.P.Lond., 4, Bentinck Street, London, W.1; Kate Millicent Fry, L.D.S.R.C.S.Eng., Bedford House, 108, Baker Street, London, W.1; George Herbert Curtis, M.R.C.S.Eng., L.R.C.P.Lond., L.D.S.Eng., 2, Weymouth Court, Weymouth Street, W.1; Norman Gray, L.D.S.Liverpool, 13, College Road, Eastbourne; Hubert Clarence Visick, L.D.S.R.C.S.Eng., D.D.S., The Wolds, College Road, Eastbourne; Clair William Roberts, L.D.S.R.C.S.Eng., D.D.S., 60, Harley Street, London, W.1; Carin Johansen, Wladimirsgalan, 16, Helsingfors, Finland.

SUPERNUMERARY TEETH.

A Short Communication by Mr. F. BOCQUET BULL.

Mr. F. BOCQUET BULL showed a series of thirteen cases illustrating irregularities in the upper incisor region due to the presence of supernumerary teeth. The models, he said, were shown in the Museum at the last Annual Meeting of the British Dental Association, and his only object in exhibiting them as a casual communication that evening was that he thought perhaps either the whole series, or some of the most interesting ones, might be of use to the Society for its Museum. He showed his models from an etiological point of view and not from that of treatment, although the majority of them had been treated. Most of the cases were self-explanatory, but there were one or two to which he desired to call attention. The only peculiar feature about the first case was the difficulty of detecting which of the three teeth was the supernumerary tooth and which were the two central incisors.

In the treatment of that case the central tooth of the three was extracted as the long axis of it was in such a very slanting condition. In the first seven cases the supernumerary teeth were all obvious—i.e. erupted; in the last six cases they had not erupted. The only point about the second case was that after extraction of the supernumerary tooth the two central incisor teeth came into perfect position without any appliance being fitted at all. The third, fourth and fifth cases did not call for any particular comment. In the treatment of the cases he showed, the actual extraction of the teeth was performed in the Out-patients' Department under ethyl chloride with the exception of the sixth case, which was extracted under a local anæsthetic. In some of the cases the actual teeth were cast in a model. In the seventh case the boy concerned was fifteen years of age and could put in no actual attendance at the Hospital, so that both the lateral teeth were extracted as well as the supernumerary tooth. For the last six cases he was able to show films as well as models. In all those cases the supernumerary tooth had not erupted. The patients were treated as in-patients and the teeth extracted under a general anæsthetic. The eighth case called for no special comment, but the ninth was a very interesting one. There were two supernumerary teeth very high up indeed. He made two attempts to get at them but regretted to say that in each case he was unsuccessful. The supernumerary teeth were so far away from the roots of the others that he thought they could be rectified without removing the supernumeraries. At the second attempt to remove them he got so near one of the roots of the second incisor that it was obviously dangerous to proceed any further. The tenth and eleventh cases showed that there was obviously some trouble which was not to be observed from a clinical point of view. The twelfth and thirteenth cases were those of supernumerary teeth in temporary dentition. They were interesting from that point of view.

The PRESIDENT said Mr. Bull had shown a very valuable collection of supernumerary teeth, both erupted and unerupted. The last two cases were most valuable as being examples of supernumerary deciduous teeth, of which the Society up to the present possessed no records.

Mr. FOURAKER said that Mr. Wilkinson had asked him to show two models relating to two girls, both of whom had tuberculate supernumerary teeth; they were sisters, one was aged 13 and the other 16. The extraordinary point about the case was that the same condition existed in each parent and that the mother's brother and the father's brother had the same condition also. The elder girl had lost her first incisor. Unfortunately Mr. Wilkinson did not take the models of the lower jaw. He thought it was somewhat unusual that the whole family plus two relatives should have the same condition.

Mr. WATKIN said he had been interested to observe that all the supernumerary teeth shown were in the incisor region, which was undoubtedly the most common place in which to find them. They did occur in other places, but generally they were in the incisor region.

Dr. J. T. QUINTERO thought that both the communications were particularly interesting. The first one interested him considerably because it entirely disagreed with the theory that was presented to those who were in Amsterdam two years ago at the meeting of the European Orthodontological Society and who had occasion to visit the Anatomical Museum of Prof. Bolk. That very interesting museum contained from 35,000 to 40,000 skulls, and on that collection Prof. Bolk had founded his theory of the development of the human jaws and teeth. Although he would not be absolutely certain about it, he understood one of Prof. Bolk's claims was that supernumerary teeth in the anterior region usually developed between the central and the lateral incisors. It seemed to him, however, that in nearly all the cases shown by Mr. Bull the supernumerary tooth had developed between the central incisors. That was not so in every case, perhaps,

but it was true of the majority of cases. That was of great interest to him as it disagreed almost entirely with what Prof. Bölk apparently contended. Personally he had come across one or two such cases in his practice and he had intended to make a record of them and send it to Prof. Bölk for his opinion, because he thought it would be valuable to get the Professor's interpretation of those cases; unfortunately so far he had not had time to do so. He considered the second communication exceedingly interesting also, because it presented what might seem to be a case of hereditary abnormality. It was very curious to see the same thing occurring in different generations. One gentleman said that supernumerary teeth were seen chiefly in the incisor region. That was so, but they were often found on the buccal surfaces in the molar region, and they were then usually peg-shaped. He had occasion three or four years ago to extract two supernumerary premolars; one was the upper right and the other the lower left, both in the same person; that was the only point of interest in his case. It was somewhat remarkable that two such cases should occur in the same person, one in the upper jaw on one side and the other in the lower jaw on the other side. They were premolars, which was also rather unusual.

The PRESIDENT said he had much pleasure in calling on Dr. James Quintero of Lyons, an assistant professor in the Dental School of that city, who had come to London specially for the purpose, to read his paper to the meeting.

Dr. JAMES T. QUINTERO then read his paper.

SOME USES OF AUXILIARY SPRINGS IN CONJUNCTION WITH LABIAL ARCHES.

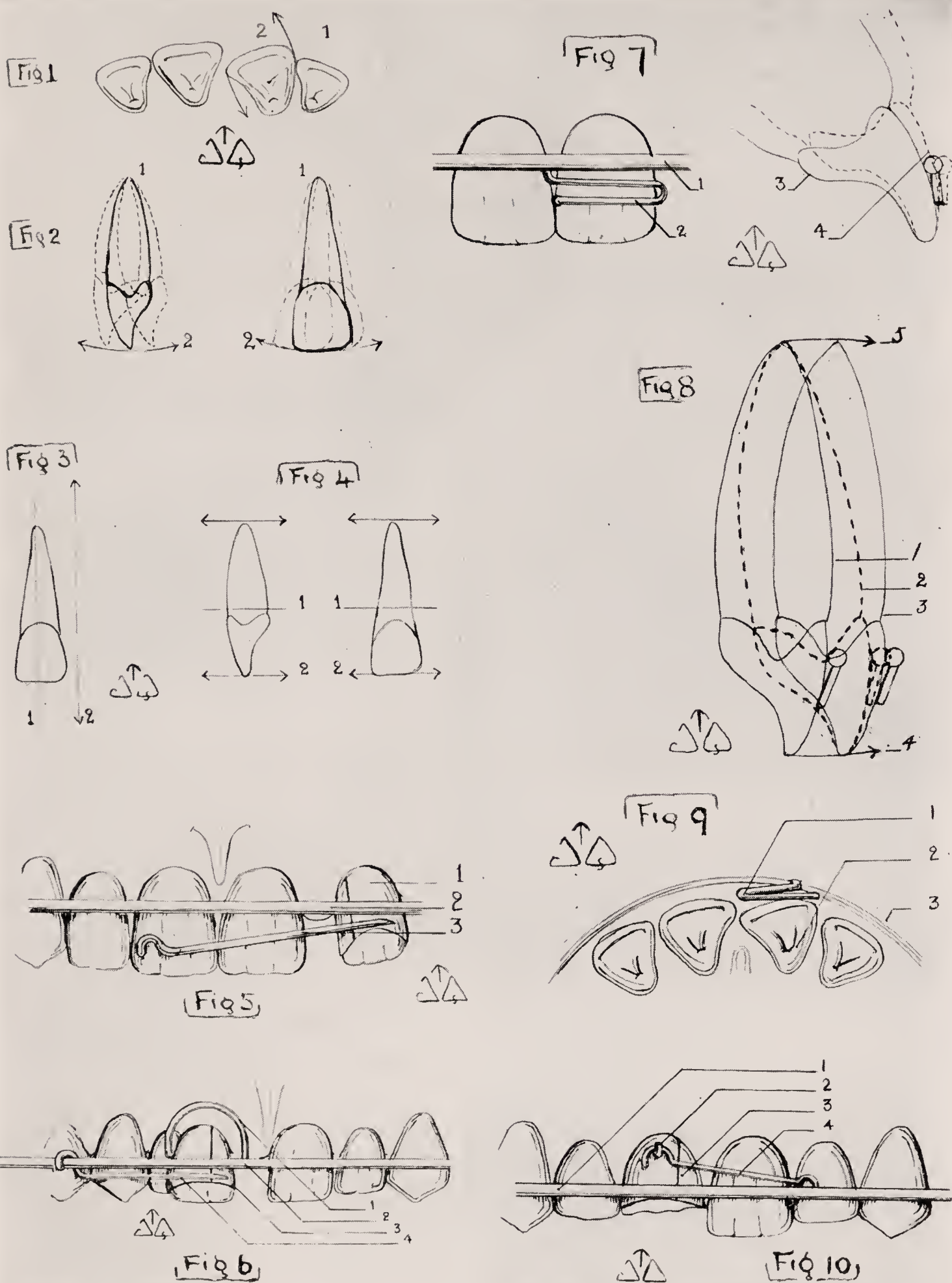
By DR. JAMES T. QUINTERO.

(Assistant Professor, Ecole Dentaire de Lyon.)

IN bringing this subject before you for consideration this evening, I am well aware that it has often been gone into quite extensively, and therefore I fear that I will have nothing very original to offer you. I will, however, endeavour to throw a little light and put some order in what I consider one of the most confused and unsettled parts of our technic. I would like to bring to your attention a few points in connection with the use of auxiliary springs; let us, therefore, try to analyse more closely than is usually done the purpose for which these springs are used—namely individual tooth movement—their method of construction, and their application to a few concrete cases. A problem correctly stated is half solved, as the saying has it, so let us examine the problem set to us by any orthodontic case. Our aim being to take an underdeveloped mouth, with probably a crowded arch, and possibly malrelation of the jaws, and make this into a properly proportioned face, with correct functional and æsthetic balance of both soft and hard tissues, what varieties of movement will have to be accomplished before our result is attained? We will be called upon, first, to properly develop the under-developed jaw-bones; second, to correct their malrelation; third, to properly train the facial muscles, and lastly to attend to individual tooth movements. All of these partial corrections may possibly be carried on simultaneously, but their study requires separate consideration: the three first points have nothing to do with the subject of this paper, so we will dismiss

SOME USES OF AUXILIARY SPRINGS IN CONJUNCTION WITH LABIAL ARCHES.

By DR. JAMES T. QUINTERO.



them entirely, to devote our attention to the various elementary movements of the teeth, and the methods and means of obtaining them.

DIFFERENT VARIETIES OF ELEMENTARY TOOTH MOVEMENT.

Numerous authors have described the many possible movements of any tooth, but a careful and scientific examination of facts will bring you to realise that, mathematically, all tooth movements may be reduced to two elementary varieties: a tooth may be moved *around* one of its three principal axes, or its displacement may be *parallel* to one of them. There is no other possible tooth movement.

I will now take the liberty of defining certain terms which I will use in the course of this paper, so as to avoid misunderstandings.

Rotation (L. *rotatio*). A movement around the long axis of a tooth. Rotation of any given tooth is defined by stating (1) the angle of the tooth considered, (2) the direction in which this angle is displaced. For instance we would speak of a mesio-lingual rotation of a central incisor, meaning that the mesial angle of the tooth is turned in a lingual direction, which from a mathematical standpoint could equally well be called a disto-labial rotation, since a rotation of one angle around the long axis must needs have its counterpart at the opposite angle (Fig. 1).

Version (L. *vertere*, to turn). A movement around one of the short axes of a tooth, namely, the mesio-distal or the linguo-buccal (or linguo-labial). Version of any given tooth can be defined by stating the direction in which the crown of the tooth is displaced. For example: when a molar used as anchorage gives way, and tips backward, its displacement is termed a disto-version (Fig. 2).

Trusion (L. *trudere*, to displace with force). A radical, meaning a vertical movement of a tooth parallel to its long axis, and used only with a prefix: *intrusion*, a vertical movement parallel to the long axis of a tooth, toward its apex; *extrusion*, a parallel movement in opposite direction, i.e. away from the apex. When an upper incisor with a broken tip is brought downward, so as to make its apparent length equal to that of its mate, it is displaced by extrusion (Fig. 3).

Gression (L. *gradi*, to advance). Horizontal movement of a tooth parallel to one of its short axes. A gression is defined by using a prefix indicating the direction in which the tooth is displaced; for example, mesio-gression of the first molar often occurs after premature extraction of the temporary molars (Fig. 4).

These terms, as defined are used both for describing the condition of a misplaced tooth, and for indicating the movement which may have brought it to this false position or will bring it back to its normal situation. You will notice that the two first terms refer to movements around an axis, and the two last to movements parallel to an axis. In each case it has been deemed advisable to use a separate term for vertical movements, and a different one for horizontal displacements. Let us now consider for instance an incisor tooth; we may describe three axes to it: a long axis, which is approximately vertical, and two short or horizontal axes, which are labio-lingual and mesio-distal. If, as in the example given above, we now imagine that this tooth is broken and must be

extruded, we can very well see that the movement accomplished will be parallel to its long axis. The same holds true, of course, for the opposite movement, were it necessary.

If we apply any of the root-moving appliances, and displace a tooth labially, for instance, it stands to reason that the movement produced will be along the linguo-labial axis, provided we moved the root and crown an equal distance. Here again the same holds true if we have brought about the contrary movement, displacing the tooth lingually. Finally, any bodily movement along the line of the arch must, for the same reason, be parallel to the mesio-distal axis of the tooth displaced. We therefore see, as was to be expected, that all bodily movement of teeth must be made along a line parallel to one of the axes, and in France, for that reason, such movement is termed "parallel movement," for each axis continually remains parallel to its previous position. Now, considering again the movement around one of the axes of the tooth, it should be borne in mind that the actual centre of rotation may not coincide with this axis, but may simply be parallel with it, as we can determine neither the exact centre of rotation of a tooth, nor the exact location of any one of its axes. These circular movements we will term *rotations*, when they take place around a vertical axis, and *versions* when the tooth revolves around a horizontal axis. Thus a tooth placed in what Angle terms "torso-occlusion" is simply rotated around its long axis; likewise, a molar which is tipped buccally through excessive stress from an appliance is in bucco-version, and the treatment which corrects it will of course be a linguo-version. Any two of the above movements may exist, or be carried on at the same time, provided they are not contrary in direction: one of them may be a parallel movement and the other may be a circular one, or both may be of the same type. In fact it is quite usual that any tooth movement is a combination of two or more of the elementary movements, so that most tooth movements are complex, and composed of a greater or lesser number of elementary movements, and are rarely reduced to one single elementary form.

AUXILIARY SPRINGS AS USED IN CONJUNCTION WITH LABIAL ARCHES.

My first conception of auxiliary springs used with labial arches was intended to allow rotation of teeth without bands. Many authors have tried to attain this result with various mechanical devices, usually consisting of double arches, lingual and labial, and different means of exerting pressure: ligatures, as in the appliance of L. Ruppe, or springs, as in J. Lowe Young's, Pullen's, H. Chapman's and my own. It is therefore by no means a new idea. However, results obtained have more often than not been mostly theoretical, and hardly, if at all, practical. Most of the authors have, for various reasons abandoned their methods, particularly on account of the uncertainty of the results obtained, and of the difficulty of keeping their devices in permanent and active contact with the teeth to be moved. I do not pretend to have solved the problem, but I consider that in certain cases springs can be used without bands, while in others they cannot. Rotations of incisors around a vertical axis, versions around the mesio-distal axis, certain versions around the labio-lingual axis, and intrusions can usually be obtained

without bands. However, rotations of canines and bicuspid, some versions, most extrusions, a few intrusions and mesial or distal parallel movements, make necessary the use of bands. It should be understood at the outset that auxiliary springs, as used in connection with labial arches, differ from those used on lingual arches, both in construction and in size. Those who are familiar with lingual arch technic will remember that auxiliary springs in such cases are made of the finest and toughest platinum-gold alloy. They are made of very small gauge wire because lingual arch technic requires the visits to the orthodontist to be at least two months apart. Labial arch technic, on the contrary, calls for more frequent visits and promotes more rapid results. Moreover, as the auxiliary springs in this case are used only for individual tooth movements and not for general expansion of the dental arch, or bone growth, there is no reason for making them long and delicate, as with the lingual appliance.

I should point out also that the auxiliary springs used for individual tooth movements may, according to cases, be attached either to the arch itself, or to the tooth, by means of a band. This naturally depends upon the movements required, the first essential being to keep the active portion of the spring as nearly parallel to the arch as practicable, the second being to avoid any cumbersome attachments, the third to have the wire as resilient as possible, and the fourth to maintain permanent contact between the active portion of the spring and the tooth. One of the principal advantages I have found in the use of these springs resides in the possibility of obtaining a more permanent action of the appliance, by making use of a continuous force, thus allowing patients to remain away longer, feeling certain that the action of the spring will not stop for some time, and that patients will not suffer from soreness of the teeth. Soreness is commonly produced by intermittent and too rapid action. If we use springs to regulate the movement of the teeth we obtain a continuous action, and the spring transforms the otherwise rapid action of the ligature into a much slower one. Auxiliary springs may be used in two opposite manners: (1) for direct and positive transmission of force, and (2) as a brake, so to speak, to slacken or arrest movement in a given direction and transform it into movement in another direction. Both of these uses may be combined advantageously to act upon single teeth, particularly when parallel movement is to be obtained. It is well known that purely parallel movement is seldom, if ever, accomplished; usually the effect of such appliances as the "Ribbon arch," or similar ones, is to first produce a tipping, or more exactly a version of the tooth, then, through the force of torsion of the appliance, to produce a second version in the opposite direction, so that first one extremity of the tooth, then the other, is advanced in turn, and gradually brought into position; the tooth thus advances more rapidly than it could were it rigidly held in an appliance that could produce only purely parallel movement, such as Case's "contour appliance."

CONSTRUCTION OF AUXILIARY SPRINGS.

As previously mentioned, springs may be attached to the labial arch directly, or to bands upon the teeth. In this case, comparatively light and very resilient wire should be used, as the spring

must be long enough to have considerable leverage, and light enough not to exert too much force and damage either to the peridental membrane or the pulp. For this purpose I use gold-platinum retaining wire manufactured by the S. S. White Company, of exactly the same composition as is used for lingual appliances. This material provides a very good force for all movements. When used on bands, the spring is soldered in whatever position desired, care being taken to place it where it will not come into contact with the arch, and to leave it sufficiently long to give a good leverage ; it may conveniently terminate in a small hook or loop opposite the next tooth but one.

(1) If, for instance, a mesio-version of, say, the left lateral incisor is desired, the tooth would be banded and the spring soldered to the band would extend over mesially as far as the right central incisor ; it would consist of a plain wire .55 or .63 mm. in diameter, ending in a hook or loop. The wire would be placed at right angles to the long axis of the tooth and therefore it would not lie exactly parallel to the arch, but diagonally towards the incisal edges of the teeth (Fig 5). Two methods can be used to connect the spring with the arch : (1) it may be attached directly by means of the hook which terminates the free end, or (2) it may be secured by means of a ligature. I have found it more convenient, as a rule, to place the springs near the incisal edges of the bands rather than at the gingival border, so as to avoid traumatism to the gum. Of course, if the opposite movement were desired, namely a disto-version, the spring would be directed towards the bicuspid instead of the centrals.

(2) Let us now consider the case of a mesio- or a disto-gression. We would band the tooth to be moved, and as the movement to be obtained is a parallel movement the spring from the band should be as nearly parallel to the arch as possible, and should terminate in a hook so as to obtain a more fixed attachment to the arch. The next step would be to solder to the arch an auxiliary spring, which we can conveniently form into a loop extending gingivally and ending in a finger which will gently, but firmly, press the tooth in the desired direction. The spring on the band could be a .55 or a .63 mm. wire (B. and S. gauges $23\frac{1}{2}$ and 22 respectively), and the one on the arch a .63 or a .76 mm. (B. and S. gauge $20\frac{1}{2}$), the arch itself being a 1 mm. (B. and S. gauge 18) wire (Fig. 6). Now, when our arch spring applies force to the tooth, it simply produces a mesio- or disto-version, as the case may be ; and in so doing it also bends the spring on the band, which is considerably smaller, until a balance between both these forces is established. Then, as each spring continues to exert its force, the arch spring very rapidly becomes less active for, being the stronger of the two, it spends all its force and reaches its position of rest before the smaller one ; finally the smaller spring attached to the band continues its work and rights the tooth without interfering with its position, which is maintained by the arch spring. If, at the end of this time, the desired position is attained, well and good ; if not, the arch spring is tightened again and the tooth is displaced a second time in a similar manner. In short, as you see, mesial or distal displacement, whether it be by version or parallel movement, can best be accomplished by banding the tooth and extending from

the band a spring to be attached to the arch. In one case this spring does all the work, and in the other it serves as an adjuvant or corrective to the principal spring attached to the arch.

(3) Horizontal displacement in a direction perpendicular to the arch, labially or lingually, does not as a rule require the use of bands. It is usually sufficient to attach a spring to the arch, using a .63 mm. (B. and S. gauge 22) wire. The shape of the spring is rather particular, and is designed to give it as much resilience as possible. This result is obtained by soldering the wire perpendicular to the arch, in the vertical plane, and bending it sharply at 90° to make it lie along the arch, and about 1 mm. from it. Then, at a proper distance it is bent back sharply at 180° and made to lie parallel to the arch again and about 2 or 3 mm. from it. This double bending will bring back most of the temper taken out of the wire by soldering. The wire, after its second bend, constitutes the spring which is to direct the movement of the tooth. It should therefore be brought into such a position that it will act upon the tooth in the desired direction. The tooth is then ligated to the arch and the spring will regulate the movement of the tooth (Fig. 7). If the movement is to be a labio-version no spring is necessary, and the ligature alone suffices. If the movement is to be a linguo-version the spring should not at once be given its final position, but only an intermediate one, so that the action will be gentle.

(4) If the movement is to be a labio-gression the spring should press lightly on the *labial* side of the tooth. When the ligature is tightened the spring also is tightened, *ipso facto* but as its point of contact with the tooth is much nearer the incisal edge it will promote root movement by its lever action. The result will be first a labio-version, through tightening of the ligature, then, as the force of the ligature is almost spent, the spring, in its turn, exerts a continuous pressure which slowly and steadily rights the tooth (Fig. 8). I have never found occasion to perform the opposite movement, linguo-gression, with these springs, and will not, therefore, describe any appliance that I have not used myself, but it would be easy to devise one. We have passed in review all of the movements of the teeth around horizontal axes, or parallel to them. Let us now examine rotations and vertical parallel movements.

(5) Rotations of the four anterior teeth can be accomplished by means of springs without the use of bands. Canines and bicuspid are best rotated by the usual methods. In the case of canines, springs may be used as well as bands to help the rotation, but for bicuspid their usefulness is not as yet demonstrated. The spring, in this case, is a .63 mm. (B. and S. gauge 22) wire attached to the arch and shaped by a double bend, just as previously explained (Fig. 7), the free end resting close to the outstanding corner of the tooth to be rotated. If the tooth is also somewhat lingual to normal the rotation will usually be more easily accomplished (Fig. 9).

(6) Vertical movements of the teeth, intrusion and extrusion are accomplished by the use of a spring soldered to the arch. It is well to use a rather light wire, such as .55 mm. (B. and S. gauge 24) for extrusion, and a stronger one such as .63 mm. (B. and S. gauge 22) for intrusion. The tooth is usually banded, and the band carries, near its edge, a bracket or spur, in which the spring will engage.

The spring is soldered to the arch in a vertical plane bent in a half circle about 2 mm. in diameter, and bent again sharply to lie along the arch. It should be attached sufficiently far from the tooth to be moved to allow it to be resilient and not too powerful. It terminates in a hook which engages in the bracket on the band. Before placing the appliance in position in the mouth the spring is bent so as to exert the proper force in the proper direction (Fig. 10). Intrusion movement may be obtained without banding the tooth by hooking the spring around the incisal edge of the tooth, but the use of a band is usually to be recommended.

As has been explained, the use of these auxiliary springs in conjunction with labial arches is intended only for individual tooth movements, usually after expansion has been successfully accomplished, or in such cases where little or no expansion is demanded. This does in no manner preclude the possibility of expanding the arch with the same appliance as used for individual tooth movement, and at the same time.

Having explained the theory of auxiliary springs, I will now show a few cases in which I have used them to some advantage. In the following illustrations the appliances are shown upon casts of the teeth after treatment. The other casts show the condition before any appliance was put on.

(The essayist then threw some pictures on the screen showing the use of auxiliary springs in several cases, and also passed around some models with the appliances in position, as used in the mouth.)

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THE ILLUSTRATIONS.

- Fig. 1. Rotation : (1) axis of rotation, (2) direction of displacement.
- Fig. 2. Versions : (1) axis of versions, (2) direction of displacement.
- Fig. 3. Trusions : (1) axis of tooth, (2) direction of displacement.
- Fig. 4. Gressions : (1) axis of teeth, (2) direction of displacement.
- Fig. 5. Appliance for mesio-version. (1) band, (2) arch, (3) auxiliary spring on band.
- Fig. 6. Appliance for mesio-gression : (1) auxiliary spring on arch, (2) arch, (3) band, (4) auxiliary spring on band.

- Fig. 7. Appliance for linguo-version : (1) arch, (2) auxiliary spring, (3) primitive position of tooth, (4) final position of tooth.
- Fig. 8. Appliance for labio-gression : (1) primitive position of tooth, (2) intermediate position, (3) final position of tooth, (4) primary movement of tooth, (5) secondary movement of tooth.
- Fig. 9. Appliance for extrusion : (1) arch, (2) bracket on band, (3) band, (4) auxiliary spring on arch.
- Fig. 10. Appliance for rotation : (1) auxiliary spring on arch, (2) rotated tooth, (3) arch.
- Fig. 11. Disto-version (and extrusion) : (1) before, (2) after.
- Fig. 12. Disto-version : (1) before, (2) after.
- Fig. 13. Mesio-gression : (1) before, (2) after.
- Figs. 14 and 15 and 16. Linguo-version : (1) before, (2) after.
- Fig. 17. Labio-gression : (1) before, (2) after.
- Fig. 18. Extrusion : (1) before, (2) after.
- Figs. 19 and 20. Rotation : (1) before, (2) after.

DISCUSSION.

The PRESIDENT said that Dr. Quintero had presented a very excellent paper. He had discussed his subject from the theoretical and the practical point of view and shown the application of all his theories. He invited discussion.

Mr. HIGHTON thanked Dr. Quintero for all the instruction and information he had given, and for pointing out so carefully the different forms of tooth movement and the nomenclature of the various movements brought about. He was interested in what Dr. Quintero said about extrusions. He wondered whether in bringing the teeth into position he had to retain them for any length of time, and if so what length of time he found necessary, and if even after retention there was not a tendency to relapse. Dr. Quintero had shown several cases with a certain amount of expansion. He took it that Dr. Quintero used a lingual arch and he wondered whether he found it necessary to use accessory springs on the lingual arch in conjunction with the buccal arch to accomplish some of the movements referred to. Apparently a great deal of movement could be brought about rapidly with accessory springs on the buccal arch, but he would like to know whether it was necessary to retain those teeth at all or whether Dr. Quintero allowed the auxiliary spring itself to form a retainer for the time being. Dr. Mershon, who was in London in June last, suggested the use of rest periods when using lingual arches. He did not suppose they were necessary for the treatment of the cases referred to by Dr. Quintero, but wondered if Dr. Quintero had ever abandoned movement for a time and adopted rest periods or whether he always used continuous movement. It was stated that a small amount of tension was put on the accessory springs in the first place. He would be grateful if Dr. Quintero could state definitely the amount of tension which he actually used at various periods.

Dr. QUINTERO said that was largely a matter of practice.

Mr. NORMAN BENNETT said he had been particularly struck by the ingenuity of the arrangement for producing what Dr. Case called many years ago a bodily tooth movement, but what he himself would prefer to term a movement of translation into a position parallel with the original axes. The plan suggested by Dr. Case years ago was no doubt mechanically correct, but it involved an enormous resistance on the part of the tooth to be moved, a resistance so great that probably the so-called anchorage would come away before the tooth itself was moved. Dr. Quintero, by the ingenious arrangement he suggested in the early part of his lecture, showed how with two springs the second spring only came into operation gradually at the time when the first spring was ceasing to act and that it was intensified in its action at a later stage. In that way he produced a sort of see-saw arrangement, the movement of rotation being in one direction first followed by

rotation in the other direction, so that the final result brought the tooth into a position parallel with the original axis. That seemed to him highly ingenious and reminded him of the action which he thought everybody employed in using the fissure burr to cut out an amalgam filling. In doing so one did not cut parallel to the direction of the burr but used a see-saw movement and was thus able to get on much quicker than if one went straight ahead. Dr. Quintero got over his resistance not in one go, as it were, but first in one way and then in another and so corrected it. He thought that was highly ingenious.

Mr. NORTHCROFT said it seemed to him one of the points Dr. Quintero brought out was the desirability, which had been so often mentioned before, of having an international nomenclature so that orthodontists in every part of the world could speak the same language. He thought the terms Dr. Quintero used to express the various tooth movements that were required, having in view the fact that those terms explained the positions of the teeth as well and that they were universally used in France, were certainly desirable ones, and might very well come before the attention of the Society's own Nomenclature Committee. One point in regard to which he would like further elucidation was as to when Dr. Quintero used auxiliary springs on the labial arch—whether when he used horizontal tubes on the molars he was careful to lock the upper arch to those molar teeth or not. It was obviously not necessary when a vertical tube was used on the molar teeth to do so, but if the arch working in horizontal tubes was not locked in some way a great deal of the resilience of the auxiliary springs must necessarily be lost. He would welcome further elucidation of that point as it was not brought out very clearly in the paper.

Mr. FRIEL wished to join with other speakers in thanking Dr. Quintero for coming so far to give the members the opportunity of listening to his excellent paper. It was of great benefit to orthodontists when the facts referring to any branch of orthodontics were placed in orderly sequence and that was what Dr. Quintero had done. He could not say that he was altogether in agreement with Dr. Quintero on the reasons for using thicker auxiliary springs on a labial arch than on a lingual arch. He understood Dr. Quintero to say that it was because one did not require bone growth; but if one moved a tooth at all one must get absorption and reformation of bone, and surely that was bone growth. He quite agreed with Dr. Quintero that thicker springs must be used, but his own reason for their use was different. His reason was that it was not so difficult to keep an auxiliary labial spring in place. The movement of the lips in mastication moved the spring about, and though a weak spring was desirable it could not be used. He would like to ask Dr. Quintero how often the ligatures had to be altered in those cases, because his own experience was that if one did not alter ligatures fairly frequently one got a stain on the enamel from a brass ligature which was very difficult to remove, and which it was difficult to persuade the patient was not caries. His only objection to labial springs attached to labial arches, and especially those springs that were parallel with and close to the labial arch, was that they were so difficult to keep clean. The area that was covered by the wire arch and the spring was so wide that the ordinary movement caused by the toothbrush did not expose the whole area to be cleaned, and one was very liable to get decalcification of the teeth underneath the spring and arch.

Mr. WATKIN wished to associate himself entirely with Mr. Norman Bennett's remarks. He had come from Liverpool to hear the paper, and he would go back content even if he had only learned one of the things that Dr. Quintero mentioned, namely, that relating to the use of two different springs of different strengths.

Mr. CALE MATTHEWS said that there was just one point which when reading the paper over he felt some anxiety about, and that was that

apparently Dr. Quintero was going to add very many more difficulties to those which already oppressed people who were engaged in teaching the subject of orthodontics owing to the coining of new words, but since he had heard the paper read and had followed it through he realised that there was something very important in those terms that Dr. Quintero used. In regard to one sentence in the paper he would like to sound a note of warning, and that was in regard to the period of time between inspections by the orthodontist. In the last few years there had been great enthusiasm for metal arches. He defined them in that way because they were applied as lingual arches and as buccal arches. It was being taught very largely that one might send patients who had been fitted with them away for months without attention. Whatever the results might be from a purely tooth-moving point of view, he could not but deprecate that most sincerely. He thought it was dangerous to send patients away for months with appliances in their mouths. Damage was bound to occur to the tooth structure under the ordinary conditions in which children lived and were looked after. Such ideas were all very well in the case of a skilled orthodontist who had every preparation made with his appliance, but the discussions which took place and the papers which were read before the Society were followed by all the younger members of the profession who were now taking up orthodontic work, and they might infer that they could take a much greater liberty with their appliances than they were in fact justified in doing. That was the only criticism he had to offer, and it was not so much a criticism of Dr. Quintero's paper as of a tendency which was so prevalent to-day, to think that modern orthodontic appliances mainly looked after themselves.

Mr. MAXWELL STEPHENS emphasised the point raised as to caries arising in connection with the accumulations which must occur about the springs. There was another point he would like to mention, and that was in regard to the case which Dr. Quintero had mentioned that the President had asked him to show. He would like to know what time was occupied in the movement of the teeth into the central position and also if any experimental radiography was carried out.

Mr. H. E. MARSH said he had only point to raise, namely, whether in the carrying out of the mesio-version movement in the first appliance shown, where there was a band connected to the tooth with a spring carried forward to the tooth and then raised up to the arch by means of a hook or a ligature, one would ever get extrusion of the tooth as well as mesio-version. It had occurred to him that that lateral was bound to be elongated. He hoped that he was wrong about that because it had struck him as being a very excellent way of carrying out mesio-version.

Mr. PITTS asked if Dr. Quintero could say after he had treated his extrusion cases what was the position at the gum margin. It would almost seem as though there must have been some exposure of the cementum at the neck of the tooth. If the tooth dropped down to the level of its neighbours there must have been complicated changes in the apical region. He would like to know whether he had understood Dr. Quintero correctly to say that one could combine expansion together with the use of those arches, because it seemed to him that arch was being used as a rigid scaffold for the adjustment of the springs, and if one carried out expansion as well one might get changes in the arch which might affect the action of the auxiliary springs.

Mr. ROBERT LINDSAY said that had Dr. Quintero dealt with any of the first three of the four sections into which he divided the whole duty of the orthodontist, he might have had some reason for intervening, because then they would have been on the delightful ground of pure theory where any amount of discussion might take place without harm. Unfortunately—in one sense—Dr. Quintero confined himself to the one practical section, and therefore naturally he (Mr. Lindsay) felt inclined to leave the discussion to the practical orthodontists

present. It appeared—criticising the discussion and not the paper—that everything Dr. Quintero had said was right. One thing he would say was that the diagrams and the manner in which he explained them were so satisfactory that there was no difficulty in getting at his meaning. It must be a matter of general satisfaction and congratulation that the cases with which Dr. Quintero demonstrated the effects and the application of his theory and of his springs, were so apparently successful. He also, like another listener, had wondered what happened in the apical region of extruded teeth. His friend Mr. Wilson Charles had whispered to him that what was going on there was the interstitial deposit of bone. Mr. Charles had forgotten evidently that the socket of the tooth was a surface and that any deposition which took place in that locality would therefore be surface deposition. Perhaps Dr. Quintero could say what his experience had been in that connection because unless one could get deposition of new bone behind that extruded apex there would surely be retrusion or intrusion and the last stage might be worse than the first. Like Mr. Pitts, he was interested in the question of the gum margin and the possibility of the exposure of a part of the cementum in these cases of extrusion, but he thought Mr. Pitts would agree that exposure of a small part of the cementum would be a very minor calamity compared with the alternative necessity for prosthetic restoration of the point of the tooth. With reference to the very remarkable case which Dr. Quintero showed at the end of his paper, it would have been of great interest if Dr. Quintero could have given the details of the treatment step by step. The actual extent to which the occlusion was restored would hardly have satisfied those who, he understood, held that if between absolutely correct and normal occlusion and what was effected either by restoration, by filling, or other means, there should be one-third of a millimetre of difference, one might ruin not only the health and the dentition of that individual but also his immortal soul.

The PRESIDENT said that before calling on Dr. Quintero to reply, he would like to say that he had been particularly struck with the ingenious way in which Dr. Quintero had been able to tip the incisors. He was not quite sure that it was necessary to have bands in every case, however, in order to do that. He remembered a short time ago removing a lateral in order to get the central over into its place, which of course would result in tipping unless there was some special arrangement. Although probably he did get some tipping he averted most of it by means of a spring at the side of the tooth towards the gap—this spring at the tip of the tooth exerted less force than the spring which was employed to move the tooth into the space, and acted on the medial surface near the cervical margin. By this method he obtained the same effect as Dr. Quintero but without a band. It would require a favourable tooth and a favourable patient to use L's method, whereas Dr. Quintero's was applicable in every circumstance. He had been a little disappointed that Dr. Quintero had not referred to the high labial arch because personally he had found that in certain cases it was an extremely valuable appliance, especially where he had wanted to get a slight rotation. He had to admit, of course, that it could not usually be used without the lingual arch for that purpose, but one got a very delicate pressure which would go on for a long period and do the work most efficiently. There was only one criticism he had to suggest and he hesitated to do so because Dr. Quintero had told him that he had adopted one of his suggestions recently and found it most difficult to work. The suggestion he now wished to make was of a similar nature, and he therefore had great diffidence in putting it forward, but it did occur to him that if the springs were soldered to the arch instead of to the band, and the fixed point or catch put on the band instead of the arch, the appliance would be simplified greatly in its efficiency, because if the spring broke it could be so easily replaced. Whether that was practicable or not he could not say, not having

tried it. The discussion did show, as Mr. Lindsay said, that the members appreciated very much the paper which Dr. Quintero had presented. Their criticisms were really on very minor points, and showed that they had been greatly interested in what Dr. Quintero had said. He thought the audience present that evening was the best evidence the Society could offer to Dr. Quintero of their appreciation of his kindness in coming so long a journey to give them so excellent a paper.

Dr. QUINTERO, in reply, thanked all those who had taken part in the discussion. It had been a great pleasure to him, he said, to hear their views, and he highly appreciated the criticisms which had taken place. He feared that most speakers had been too kind to him in their expressions of appreciation for what he had done. He did not think his paper embodied very much original work in spite of what one speaker had said. He had tried to pick out right and left the best things he could find from different authors and transform their ideas to suit his needs, and that was the way in which he came to evolve his ideas of springs on labial arches.

Mr. Highton had asked him if he had experienced relapses in cases of extrusion. One could always, of course, have a relapse in a case of extrusion if the result was not retained long enough. He had always found that extrusion was the hardest and the most difficult of all the movements to retain because, as Mr. Lindsay put it, there is no interstitial bone deposit there; it was only surface growth and it was very slow in coming. A tooth would not remain in a fixed position unless it was in a socket, and that socket did not exist, or unless there was something to hold the apex of the tooth. That was most necessary in cases of extrusion. If one extruded a tooth two or three millimetres it would take two or three millimetres of bone growth at the apical end before that tooth would remain in the position to which it had been brought down, and that bone growth might take at least two years to occur. He had had cases that had been retained for over a year, and when the retainers were taken off the tooth had gone up again and he had had to put on another appliance to do the work over again, which proved that the bone had not been deposited at the apex. If a case of extrusion, though retained for a year, was found to go back, it would be better to retain it for two years and find out if that was enough.

With regard to rest periods with those arches, he was accustomed to see his patients about once a month and tighten or change their ligatures, so that most of the work was done in the first week and they had three weeks of rest. The treatment therefore went on comparatively slowly and without any discomfort to the child.

Mr. Norman Bennett mentioned double rotation around one of the short axes. That action was obtained not only with the springs but also with the ribbon arch. When one tightened a ribbon arch the first thing that happened was that the crown was displaced and displacement of the roots only happened at the end. One got exactly the same kind of double version as one did with the springs; there was practically no difference.

Mr. Northcroft's remarks on nomenclature were very timely, of course. He quite agreed with him that a definite nomenclature was needed. He wished to mention, however, that the terms used in his paper were not of his own invention. French orthodontists had been at work on the problem of nomenclature for at least eighteen years. The first to give attention to it was probably M. de Nevrezé, on his return from America in 1906 or 1907. He proposed a nomenclature and classification of malformations and malocclusions as well as an interesting classification of movements of the teeth. Another nomenclature was introduced by Dr. Frey, a lecturer at the Faculté de Médecine of the University of Paris. Yet others were produced, and finally Frey, Lemièrre and Villain got together and evolved a nomenclature of which the terms he had used formed only a small part. That

nomenclature provided for terms defining all the malpositions of the teeth and the alveolar borders of the maxilla and the relationship of the arches. Finally Izard, about a year ago, gave a synopsis of a nomenclature which seemed to be better than the others, and in which a certain number of terms were omitted. Nearly all those nomenclatures were alike and the terms which he himself employed were found in practically all of them, so that all those French teachers used the same nomenclature in their work in their different schools. Personally he used it in his own work in teaching; the same terms were used all over France.

Mr. Northcroft had asked a question which he could best reply to by means of a sketch.

Personally he used a sort of elastic or resilient lock which consisted of a loop. If A represented the horizontal tube B was the wire that went into the tube and was $40/1,000$ " thick for the labial arch. Between the bicuspid he soldered on a vertical wire $25/1,000$ " in diameter and which was fixed in the manner shown in the sketch, coming just in front of the arch at the point C. It described a circle round the arch so that it made another loop around it and prevented the arch slipping into the tube any more than was desired. By opening that loop of course one could push the arch forward and by closing it let the arch come in more. That was, he thought, the invention of Dr. Oliver.

Mr. Friel had asked about the absorption and formation of bone. Whenever one displaced teeth some bone growth took place, of course, although certain experiments, conducted in 1903 or 1904 by an investigator whose name he had unfortunately forgotten, seemed to show that that was not always the case. The investigator in question mixed some dye into the food of certain animals for a certain number of days and, after the dye had been suppressed from the food, submitted the animal to tooth movement and found that the bone was coloured all around the teeth, and that there was not any uncoloured bone around the teeth which had been moved which proved there was no production of new bone. The bone, apparently, was simply bent. There did not seem to be any absorption of bone and formation of new bone around the teeth that had been displaced.

He knew that ligatures did stain the teeth. When wire ligatures were left on for a long time, very disagreeable stains were sometimes produced. In some mouths the stains were produced more quickly than in others and were much harder to remove, but in some mouths the ligatures could be left for several months without producing any stain at all. It depended not only on the care taken by the child of its mouth, but on the saliva and the food taken by the child, etc. He usually changed the ligatures about once a month, when he thoroughly cleaned the teeth and removed any stains that might be present to avoid the possibility of caries.

Once in a while he found decalcification of the teeth. He did not know whether decalcification could be attributed absolutely to the appliances or not, because it did not always seem to occur in contact with the appliances. One often found decalcification of the teeth around the precious metals. Before the war, when he was able to use platinum bands—which he could not get nowadays—he did have decalcification under the bands even when the cement was in good condition and the band remained cemented in place and was not removed until the end of the treatment. Sometimes when he took the band off he found decalcification under it, which was doubtless due to the presence of platinum in the band. He had not found decalcification under the gold he used for his bands, because he always used 22 carat gold; he found that answered the purpose just as well as anything else. He certainly thought that any metal which contained a high percentage of platinum might be dangerous to the teeth. In most cases he had not had any marked decalcification.

Mr. Marsh had been kind enough to express interest in the case he showed at the end of his paper and had asked about skiagrams being taken from an experimental standpoint. He did not have anything like that done. The patient was not wealthy and had to come up from the country about seventy miles each time, and as he himself did not possess an X-ray machine he did not like to ask them to have X-ray photographs taken simply for experimental purposes.

The next speaker asked whether he had had extrusion with the appliance for mesio-version with the band on the lateral. He had not found that to be the case; on the contrary, as the spring was attached to the arch, which was considerably nearer the gingival portion of the tooth, it naturally tended to bring that tooth up rather than down—to intrude rather than extrude it.

Mr. Pitts seemed afraid that the cementum might be exposed when the extrusion movement was carried on. Personally, it had been his experience that the gum line always followed the movement of the tooth. The gum always descended with the tooth and he had not so far seen any exposure of the cementum. On the contrary, he had sometimes to cut away the gum because it had come down too far. In such a case there would be a small exposure of the cementum, but there were apparently no ill-effects from that.

With regard to a combination of expansion going on with the use of these springs, as he mentioned at the end of his paper, one could very well do both things together. The springs only came into play, however, on the anterior teeth—usually just the incisors and sometimes the canines—and expansion usually went on with the other teeth—usually the bicuspids and molars—so that there was no reason why one could not carry on both things at the same time, and that was what he usually did.

Mr. Chapman's appliance for distogression was very ingenious. He imagined it might be applicable in some cases, but usually he found it more convenient and less risky to use a band than to try to press on one edge of the tooth simply with a spring.

He had only used a high labial arch once or twice and it had not given him the results he had expected. As Mr. Chapman said, it had to be used with the lingual arch, and his paper was concerned with the low labial arch and not with the high labial arch. Springs attached to the high labial arch could probably accomplish most of the things that could be done with the springs referred to in his paper, although unfortunately he had not been as successful with them as he would like to have been. He supposed his patients were not particularly well chosen; there was a good deal in the proper choice of patients.

As to attaching springs to the arch rather than to the band, he quite agreed with the President that it was better to avoid attachments on the bands if possible, but in some cases it was absolutely necessary to make such attachments. In certain parallel movements along the line of the arch, for instance, it could not be done away with.

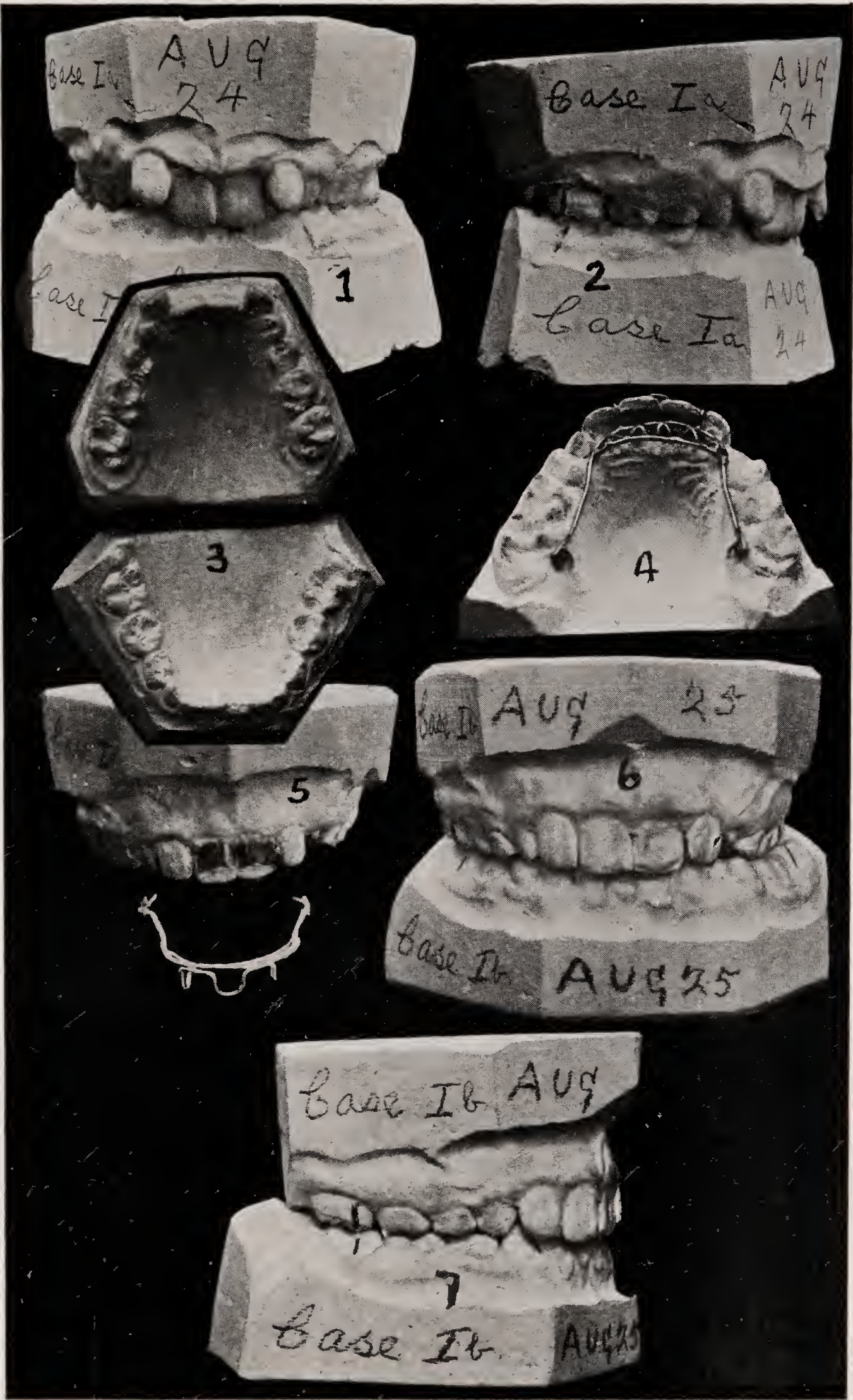
TWO CASES OF EXCESSIVE OVERBITE TREATED WITH LACE-WIRE INCLINED PLANE.

By H. E. MARSH, M.C., L.D.S.

I BRING to your notice two cases of excessive overbite that have been treated with the lace-wire inclined plane. I saw an account by Dr. Lowe Young, in the *International Journal of Orthodontia*, describing this method, and felt that it might be valuable in those cases where patients cannot be induced to wear a vulcanite plate with inclined plane. Both of these children, the first a boy, the

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second a girl, simply would not wear plates for more than a few days, either when at home or when at school. This appliance cannot be taken out by the patient, but can be removed, cleaned and replaced by the dentist very easily and quickly. Both cases come under Angle classification as Class 2, Division 2, and in both cases the overbite was such that the lower incisors were impinging on the mucous membrane behind the upper incisors.

Slide 1 shows case 1 from the front—no part of the lower incisors is visible.

Slide 2 shows the right side in occlusion. The post-normality of the mandible is evident on looking at the first molars.

Slide 3 shows the upper and lower models separately.

Slide 4 shows the upper model with the lace-wire appliance in position.

I must mention that before commencing the correction of the overbite the upper central incisors were moved forwards into alignment, by means of a labial arch and ligatures, the labial arch being held in the same molar anchor bands as were used for the lingual lace-wire. The latter is constructed on the lingual wire as follows (I here quote Lowe Young): Bands are fitted to the upper central incisors, and to these are soldered cleats well toward the labial distal surface of the band parallel to the long axis of the tooth. Heavy cleats are also soldered on the lingual side of the bands transverse to the long axis of the teeth and close to the gingival margins of the bands.

The first molars are banded, and half-round tubes soldered on the lingual surfaces of the bands parallel to the long axis of the tooth. With the four bands in place an impression is taken, the bands removed and a cast made in artificial stone. A removable lingual wire is then constructed so that it rests on the transverse cleats on the bands on the centrals. Call this the main wire. At a point near the distal margin of one of the canines, attach to the main wire with solder, another wire and carry it across to join the main wire again opposite the same place on the other side. In the space between these two wires is fitted a wire bent to and fro, so that the angles of the bends reach the wires on either side and are soldered to them, creating an open inclined plane. The wire thus used is all .036 in diameter. Close to the gingival end of the labial cleat on each central band is cut a notch. The end of a wire of .026 gauge is soldered to the front portion of the lingual wire at a point opposite the embrasure between the lateral and central incisors on one side. This is shaped so that it passes down the embrasure between these teeth, is bent labially and then arranged to pass up the labial embrasure opposite the notch cut in the labial cleat. It is then bent so as to pass across the labial surface of both central bands. A loop is bent in this wire which may present either incisally or gingivally as desired. This loop should be midway between the labial cleats. The wire is then bent so that it assumes a similar position between the central and lateral on the opposite side, and is again soldered to the lingual wire where it encounters it. If the loop in this labial wire is omitted great difficulty will be experienced in removing and replacing the appliance. It is important that this wire be bent so that it securely seats itself in the notches of the labial cleats. The object of this wire is to

stabilise the front portion of the lingual wire carrying the bite plane, and also to prevent the centrals moving labially. Then the bands are cemented on the teeth and the appliance adjusted.

It will be found impossible for the patient to get the molar and premolar teeth into contact. In both cases it succeeded in moving the lower jaw into something like normal occlusion and in considerably correcting the overbite.

Slide 5 shows the incisor bands on the model with the vertical cleats and notches. Also the lace-wire removed, showing the anterior stabilising wire and its loop.

Slide 6 shows the front view of the models in occlusion without appliances, after a year's treatment.

Slide 7 shows the right side similarly.

Slide 8 shows the models separately.

Case 2 is a similar one.

Slide 9 the front view.

Slide 10 the right side.

Slide 11 the models separately before treatment.

Slide 12 the front view after treatment.

Slide 13 the right side, and

Slide 14 the models separately.

I should add that in both these cases some expansion was carried out—in the lower by means of a lingual arch with two lateral and an anterior loop; in the upper by means of an auxiliary spring attached on either side to the main wire of the lace-wire appliance itself.

DISCUSSION.

The PRESIDENT said Mr. Marsh had shown two cases of unusual interest in which he had obtained exceptionally good results. In the first case he had opened the bite to the extent of more than half the length of the crowns of the incisors, and that must be considered very satisfactory under the difficult conditions.

Mr. A. L. PACKHAM said it seemed to him that in treating cases of the kind, in bringing the lower jaw forward, it was necessary to expand the upper arch. He should like to ask Mr. Marsh how that had been done in the two cases mentioned, whether it had been done by means of apparatus, or whether it had occurred naturally in the course of treatment. He should also like to ask how much of the apparent opening of the bite had been done by a reduction in the height of the lower incisors as against the over-eruption of the back teeth.

Mr. MARSH said he was sorry he had forgotten to say anything about expanding the arch. There was a lingual arch in the lower jaw in each case. Both arches needed liberal expansion. In the upper jaw in each case he used auxiliary springs on the lingual appliances, attaching them to the lace-wire appliances, and there was plenty of room to do so. They should be put on in front of the vertical rods that went into the molar bands and bent backwards and forwards when they would carry out the expansion of the first premolars or first temporary molars, and the temporary canines if present.

Mr. GEORGE NORTHCROFT said that in the case shown the lower incisors seemed to have been depressed only. He thought in all cases of raising the bite it was well to emphasise the point brought out so well by Mr. Dolamore when he said that such cases should be undertaken at the physiological age of eruption of either the first or the second molars; that was to say, about the age of 6 or 12, or at the time when the molars were beginning to erupt. A physiological growth of bone then took place, a normal growth, and consequently a more permanent result was likely to be obtained. Since he had been

operating on those lines he had had what seemed to him more permanent success in cases where the bite was raised.

Mr. SCHELLING said that if he had judged rightly from the models it seemed clear that the upper bicuspid had come down nearly to the length of the canines.

Mr. ROBERT LINDSAY asked whether Mr. Northcroft would agree that what took place with regard to the six and twelve-year-old molars would be equally true of the development of the premolars. He thought that was the point Mr. Schelling wished to know. It seemed to him that if the developing bone—and it was a theory which his wife and himself had taken notice of in their paper—if the deposit of bone on the alveolus, helped to carry up the six-year-old molar and the twelve-year-old molar, the same rule must apply to the premolar, and the bite would be opened in that way.

Mr. GEORGE NORTHCROFT said that orthodontists dealt with the case of molars chiefly and simply because a little growth gained at the back of the jaw meant a great deal of opening of the bite in front, whereas the raising of the first premolar would only open the jaw a very little. What they were after was to open the bite, and the best effect was obtained from the back of the mouth.

Mr. LINDSAY said he quite agreed, and it emphasised that such things were most effectually done if it were possible to get locking of that description. He thought everyone agreed that the best way to get the locking was at the posterior end of the second molar.

The PRESIDENT said that one thing he had noticed about the inclined plane was that it was very nearly horizontal rather than vertical. He had been in the habit of making his planes much more vertical, and he thought with less success, and he hoped to adopt Mr. Marsh's plan. He had used lace-wires generally with a labial arch instead of a labial section on a lingual arch, because he had found them more easy to manipulate. The additional piece across the front he had found a rather difficult thing to deal with. He had used the lace-wires without bands on the incisors. They seemed to be effective although, of course, more easily damaged.

CASUAL COMMUNICATIONS.

Mr. WILLIAM OVEY showed two cases which he had found in inspecting L.C.C. school children, and although not strictly orthodontic cases, were of unusual interest. The first exhibited a general atrophic condition of the enamel in the second dentition, the right upper incisor being affected to such an extent that a vertical line of nearly 2 mm. runs down the labial surface of the tooth with apparently no enamel covering whatever. The patient is the youngest of eight children, and attends a school for physically defective children, chiefly on account of varicose veins and inability to maintain his equilibrium when playing with other children. The supplemental tooth behind the upper incisors occurs in two other members of the family.

The second case was that of a boy having a large congenital tumour (lipoma or lymphangeoma) of the left cheek, having the appearance of an alveolar abscess, and which is the cause of considerable embarrassment to the child. The mother states that she had several teeth extracted during the fourth month of pregnancy, and was upset by the loss of her own mother a few weeks before his birth. A cyst was removed at the upper border of the tumour about two years ago, but no attempt has been made to operate on the tumour itself.

The PRESIDENT said the cases were two very admirable ones and of very great interest.

Mr. NORTHCROFT asked if the lipoma was noticed to have any effect on the position of the teeth in the mandible. Unfortunately he could not closely examine the teeth inside the mouth.

The PRESIDENT said he happened to see inside the boy's mouth that

the lower teeth were not unusual except that there was a badly carious second molar.

Mr. A. T. PITTS said the lipoma case did not seem to cause any deformity of the jaw at all. Two cases were recently brought before the Society in which the presence of tumours had caused a certain deformity. He supposed the explanation was that the lipoma was so extremely soft and elastic that it had not exerted any effect on the jaw.

The PRESIDENT exhibited two instruments recently sent him from America, one being the Clevedent Scaler, No. 24, which was very useful for unlocking a lingual arch. He also showed a pair of pliers for closing the soft locking wires in difficult cases.

SOME NOTES ON INFECTIONS OF THE GINGIVÆ ASSOCIATED WITH MALOCCLUSION.

By G. B. PRITCHARD, L.D.S.

THERE is always the possibility of gingival infection arising as a result of malocclusion, and in many cases the possibility becomes a certainty. Malocclusion is one of the most important of the predisposing causes of gingivitis, and operates in three ways.

The first, and probably the most common, is that any abnormal arrangement of the teeth with each other or the associated soft parts, promotes stagnation of oral and food debris around their necks, and consequently renders normal cleansing by efficient mastication very difficult, and thorough artificial cleansing almost impossible. This makes the probability of the infection of even a normal gingival margin greater.

The second is that malocclusion in many cases causes traumatic occlusion. This results in a chronic congestion of the periodontal membrane which always spreads to the gingival margin, and so lessens the resistance of the tissues to the average amount of potential infection present in every mouth.

The third is like the second, with the exception that traumatic occlusion plays but a minor part, if any, in the causation. That is when there is slight general crowding of the teeth. There may be no great abnormality in the position of any tooth or group of teeth, no great variation from the normal in the shape or size of the arches, nor any abnormal relationship, either vertically or antero-posteriorly, between the arches themselves, yet the teeth are either permanently or intermittently packed too tightly together. This results in a mechanical congestion of the periodontal membranes and gingivæ with results identical with those mentioned under my second heading.

In considering cases under my first heading, it is obvious that where the teeth are grossly out of their proper position—for instance a premolar erupted completely internal to the arch, or a canine completely external—the opportunities for retention of debris are ideal. The contact point is absent, or in the wrong place, the interdental papilla is abnormally formed, and in many cases the effort of mastication packs food directly into the gingival trough. These cases must in a very short time get a marginal infection.

The present day shortening of the alveolar length very frequently results in malocclusion of the upper and lower third molars. The

lower molar under these conditions may be in any position between a horizontal impaction against the posterior surface of the second molar, and a partial or complete vertical impaction in the base of the ascending ramus, or it may not be impacted at all, but have its posterior cusps covered by the loose tissue anterior to the base of the ascending ramus.

In many cases it lies external to the arch, erupting into the cheek. The variations in position of this tooth all tend to promote the stagnation and infection which is always so closely followed by a spreading gingivitis. It may be in normal position when its relationship to the rest of the denture is considered, yet its implantation is in body of jaw and not alveolus, and the soft tissues surrounding it posteriorly are not gum, strictly speaking, but epithelium covering some loose connective tissue which separates it from the periosteum. There may be a flap of mucous membrane covering the posterior cusps, or if they are uncovered, there is always a deep developmental pocket behind them. Both of these conditions promote stagnation and infection always occurs. If the flap gets ulcerated from the bite of the opposing teeth infection occurs more rapidly. In any case a localised inflammatory focus arises with a tendency to spread. This area is a common one for the origin of an acute infective gingivitis, either streptococcal or fuso-spirillary. I have recently seen two acute cases of Vincent's angina originating in this area. If an impaction occurs there is always infection if any part of the crown is exposed in the mouth. Every such tooth I have removed shows evidence of a chronic periodontitis, and the infection must have passed in from the gum margin. In the maxilla, the third molar when displaced by a deficiency of alveolar development tends to erupt external to the arch with its occlusal surface facing postero-externally. It is usually functionless. There is usually a gingival pocket which develops soon after eruption.

Traumatic occlusion is very commonly associated with mal-occlusion, and is an important factor in the production of a chronic periodontitis of a very intractable nature. It is seen most commonly in cases of post-normal occlusion with marked overbite and a secondary superior protrusion or retrusion. In these cases contact is made between the lower incisors and the cingula of the uppers, or the gum margin, before the molar articulation is obtained. Thus, at frequently recurring intervals, the whole force of the bite is taken on a limited area; a lateral strain is produced, on the periodontal membranes of the upper tooth, or the gingival margin is directly damaged. There is always a thickening of these membranes—well shown in radiographs—and even if the gum margin is not directly damaged it becomes involved secondarily by a spread of inflammation. It is only a short time before such chronically congested tissues become infected.

The results of traumatic occlusion are periodically seen in connection with individual teeth. One lower incisor tooth is frequently displaced anteriorly and articulates edge to edge with the uppers, the rest being more or less normally placed. Here one sees a strictly localised recession of the gum due to atrophy of the membrane and absorption of the alveolus. There is also a pocket anteriorly which is infected, as shown by the congested venules leading from

this area. General crowding of the teeth in their arches frequently results in their being packed too tightly together. This is usually seen at two definite periods during the years of eruption of the permanent teeth, and may persist or pass off when the eruption is complete. The first period is between the ages of eleven and thirteen, when the canine tooth is erupting. In these cases the arch is not quite large enough to accommodate all the teeth developed for it, yet not quite small enough to cause the extrusion from the arch of the last erupted tooth. The result is that the canine (usually erupting after the premolars, although the same argument holds good if the second premolar erupts after the canine) comes into an apparently good position. To do so, the premolars are pressed back against the first molar, which cannot give way because of the erupting second molar behind it, and the lateral incisor is rotated. This pressure involves the membranes and gingivæ, and in the latter one can see the results. It becomes hyperæmic and swollen, the trough becomes deeper and there is a definite exudate. This results in a short time in the deposition of seruminous calculus and infection of the tissues.

The second occasion on which this type of traumatic gingivitis may arise is when the third molars are erupting in the mandible. As these teeth erupt forwards and upwards, there is always a tendency for pressure to occur on the back of the second molars. If, as occurs in so many cases, the amount of room available for this tooth is limited, this pressure becomes excessive. In many cases the first and second molars actually move forwards. If contact points are well established the results of this pressure can be seen as far forward as the canine teeth in congested papillæ. If there is only a very slight limitation of space the pressure may be relieved when the tooth is fully erupted and in a vertical position.

A case I have recently been seeing exemplifies very well this forward movement of the first and second molars on the approaching eruption of the third. Since 1921 I have been watching food packing spaces between the first and second premolar and first molar for the onset of caries, in a girl then aged fourteen. Last month when I saw her these spaces had completely closed and the contacts were well established, and there was a fulness behind the second molar suggestive of the near presence of the third molar. The girl had well-developed arches and normal occlusion. From the clinical appearances I expect this molar will erupt fully and without much difficulty.

Many of these notes I have made may be considered more as statements of opinion rather than of fact, and I therefore give the following conclusions I have drawn from them with a certain amount of hesitation :—

(1) Wherever teeth are misplaced a very important predisposing cause of gingivitis is established.

(2) The nearer the misplaced teeth are to the ends of the arches, the stronger is this predisposition.

(3) That misplaced or impacted third molars—especially in a short arch—are the most important in this respect.

(4) That the modern well-developed mandible does not allow of perfectly normal relationship between the third molar and its surrounding soft parts.

(5) That, among other orthodontic requirements, treatment of malocclusion should be directed towards the establishment of this tooth in normal relationship with its surroundings, by making room for its anterior translation before, or during eruption. Or alternatively that orthodontic cases should be finally completed by the removal of these teeth.

DISCUSSION.

The PRESIDENT said that Mr. Pritchard had opened up a subject which he thought was quite new to the Society, and one which was undoubtedly of great importance. Orthodontists had perhaps been used to being told that their appliances were a cause of gingivitis, but it could be seen now that there were many other causes and the author had enlightened the meeting in regard to some of them.

Mr. J. H. BADCOCK said that any change in or any malposition of the teeth which led to any particles being in the gum margin tended towards gingivitis. He agreed that if a wisdom tooth was unerupted, especially if mal-posed, and if there was an opening to the tooth all the surrounding parts were likely to become infected. He did not know that he could go quite so far as the author. It seemed to him that the statement that inflammation of the dental periosteum was caused by natural pressure was highly speculative, and personally he had not met with that condition, or if he had met with it he had not understood it. It was, of course, a very interesting speculation. If it was true it was certainly worthy of notice. He did not understand the distinction which Mr. Pritchard drew between traumatic occlusion and malocclusion. It seemed to him that it was quite possible that if a tooth was so misplaced that it received stress in a way in which it was not intended to receive it, certain changes would occur in the socket surrounding it and in its own cementum. He should have imagined that such changes were rather of a physiological than a pathological nature.

Mr. A. T. PITTS said the subject was very closely related to the aims and objects of the Society, and he thought the paper was a masterpiece with not a single word wasted. There were many interesting points in it. He was naturally in agreement with Mr. Pritchard with regard to the food packing following malocclusion, yet it was quite surprising that from time to time one saw cases of very marked malocclusion in adults, often adults approaching middle age, in which the gums were extremely healthy. He had several patients in his mind who came to see him and he was always amazed to notice that the gum margins were normal and with no signs of gingivitis or pyorrhœa, and yet their mouths were so crowded that it seemed to him to be remarkable. He believed that in such cases of gingivitis and pyorrhœa, local factors alone were not always sufficient; he believed there were some other causes either connected with the structure or the bone or a deficiency of the masticatory process, which acting in co-operation with the malocclusion produces gingivitis. There was one interesting class of case he had seen that Mr. Pritchard did not allude to, although no doubt he had seen cases. He himself had seen quite a number of cases in which usually the upper incisors were inside the bite, perhaps an upper incisor being twisted round so that when the mouth was closed the upper incisor bit down between two lower incisors and acted like a wedge, forcing one of them lingually and the other labially. In all the cases he had seen there was a localised destruction of gum and periodontal membrane, sometimes extending as much as a quarter of the way down the root. That was an example of what might be called traumatic occlusion causing pyorrhœa. The only thing he could suggest was that the forcing of the lower incisor labially thinned the tissue over it to such an extent that atrophy of the gum and periodontal membrane occurred. The incisors forced lingually usually had showed a normal gum margin. He was very pleased to hear what Mr. Pritchard

had said about the third molar. Some years ago he had read a paper on the prophylactic extraction of the third molar, a paper which was very coldly received and criticised. He had pointed out that quite apart from actual impaction or misplacement there was a large number of cases in which the third molar looked to be in normal occlusion with the upper molar, but in its relationship to the soft tissues it was abnormal in that the gingival margin was abnormally deep and the normal denudation had not occurred, the result being that a chronic infected condition occurred around the tooth. He had seen a large number of cases in which chronic infection occurred, which was quiescent at times and at other times active. He believed such cases were very often the starting point of acute ulcerative stomatitis, and often of pyorrhœa. He remembered a case of a girl who was having mercurial injections for syphilis and had developed mercurial stomatitis, and it was possible to see that the infection had started round a third molar which was not impacted and not misplaced, but the gum all round it was practically on a level with the surface of the crown. The ulcerated condition had commenced in that region showing that it was due to lowered resistance. Perhaps it would be advisable, if the patient would consent, always to try and remove the third molars, except in those cases where anterior teeth had been lost and the third molar moved forward into position. With regard to traumatic occlusion and its relation to pyorrhœa, much had been written about the subject and it had been asserted that even where the occlusion appeared to be normal the cusps might be too long or the fissures too deep, and that it could only be detected by means of articulating paper. Such a condition might be a cause of pyorrhœa, but he had not found evidence for that view and he should like to hear the views of others.

Mr. LIVINGSTON asked the author if he had taken very many radiographs of the cases, and whether he generally regarded the dark line or the absence of shadow of the periodontal membrane detrimental to diagnosis. He did not think it would be safe to take a complete radiograph of the survey of the mouth and take out the dark lines and say that the teeth were suffering from traumatic occlusion or periodontitis. That had been overdone, and he believed it was started in America. He did not think Mr. Pitts had enlarged sufficiently on the very general resistance of the patients to such conditions. He thought a large factor and one that was often not sufficiently considered, was that the general tone of the patient, the tone of their alimentary tract more particularly, had its reflex almost immediately in the mouth. Conditions of lowered resistance associated even with a small degree of malocclusion would produce a large amount of gingivitis, whilst the healthy child and adult, with a large amount of malocclusion but good general tone, would remain quite free. He thought that point required a good deal more elaboration by orthodontists.

The PRESIDENT said the paper had brought to his mind two children whom he had seen recently. It had been suggested by previous speakers that the forms which gingivitis could take appeared to be innumerable. One child he had seen for some years had an excessive overbite for which it was being treated, not as successfully as he would have wished, entirely with plates, and there was a tendency to hypertrophy of the gums. It had always seemed to be high, especially on the lower incisors, so that there was comparatively a small amount of tooth showing. He had seen the girl the other day, and on the labial surface of the two lower incisors, about two or three millimetres below the free edge of the gum, there was a complete erosion of the gum tissue showing the enamel below. It was the first time he had seen such a condition, and he sent the girl to a dentist to have the teeth scaled although they were not teeth that might be described as unusually dirty. Another case recalled to him was that of a child, where the gum over the six upper fronts was of a peculiarly bright pink, almost bright red. The child, which he had known about six

months, struck him always as an exceedingly delicate child. She had returned from her summer holidays looking no better than when she went away. She was going to school in the country where he hoped her health would be improved, but he felt so strongly about the matter that he was almost taking it upon himself to advise that she should see a physician for treatment. It was quite possible that such a case came under those which Dr. Livingston had referred to, and it did seem that cases of gingivitis were of innumerable descriptions. The members were very much indebted to Mr. Pritchard for his very valuable paper. If it were possible to obtain enlightenment on the treatment of the conditions it would be of very great help.

Mr. PRITCHARD, in reply, said that with regard to Mr. Badcock's remarks expressing doubts as to pressure causing definite inflammation he did not actually suggest that, but was trying to suggest that the pressure, of an erupting third molar, for instance, as a result of its translation forward, through the teeth and on to the membranes and interdental papillæ, rather interfered with the normal circulation passing through those tissues, causing possibly an increase in blood supply or a deficiency in blood supply. His point was that the alteration in the circulation rather lowered the tissue resistance, rendering it much more prone to pick up any infection that might be in the mouth than if the altered circulation had not been present. With regard to traumatic occlusion and malocclusion, he did not think they were synonymous. Apparently many cases of malocclusion could occur without there being any traumatic occlusion. By traumatic occlusion he rather meant the absence of the simultaneous contact of the planes of the upper and lower teeth as they came into occlusion. Another example was the occlusion of the lower incisors with the uppers before the molars had definitely met, thus allowing direct pressure which caused lateral stress on the teeth before the actual stress of the bite had been taken by the molars. Many of the speakers had dwelt on the possibilities of gingivitis associated with pyorrhœa not being entirely a disease of local origin. That was a very well-established fact, he thought, because many cases cropped up where a patient had all the conditions which strongly predisposed to the onset of a marginal infection of the gum yet escaped, whereas others without those predisposing causes would start pyorrhœa which would continue in spite of treatment. Undoubtedly other things besides local conditions in the mouth could bring about preliminary degeneration of the membranes of the teeth, thus allowing them to get infected. With regard to the radiographic dark line and traumatic occlusion, he was rather working the other way from that which Dr. Livingston had suggested. If one took X-ray photographs of teeth which were definitely suffering from traumatic occlusion (for instance, in an extreme case if the posterior teeth were out and the lower incisors biting on the uppers caused a general loosening of the teeth), the dark line of an area was considerably widened, and associated with that there was a marked diminution of the sharp white line of the lamina dura, and there being an absorption of the compact bone, there was a thickening of the membrane, and in every case of that kind the condition was examined radiographically. The chronic hypertrophic conditions of the gum seen in overbite he believed to be one of the manifestations of infection of the gum margin. The infection could take on a variety of types. There could be an acute, active ulceration of the gum margin, with rapid disappearance of the dental papillæ and stripping of the root. There was also a milder condition where there was a definite fibrosis. If an enlargement had occurred to such an extent as to give rise to what might be termed a false pocket between the gum margin and the normal surface a close examination would often show a minute amount of ulceration.

On the motion of the PRESIDENT a hearty vote of thanks was accorded to the readers of short communications, and the author of the paper. In order to facilitate the use of the museum and

library, the Council had thought it wise to appoint an Assistant Librarian and Curator, and Miss Violet H. George had undertaken to fulfil those duties. The Society had received a cordial invitation for any or all of the members to attend the International Orthodontic Congress to be held in New York on August 16th to 21st, 1926. That was the week immediately preceding the week of the International Dental Conference to be held in Philadelphia, so that the members attending one could attend the other. The British Society was a component part of the Congress, and the members were all entitled to attend. That, however, did not entitle them to receive a copy of the *Transactions*, and to obtain this it was necessary for each person requiring it to become a member of the Congress. The members of the Society had also been invited to read papers or present communications to the Congress, and he was certain any contributions would be welcomed.

THE Annual General Meeting was held at 11, Chandos Street, Cavendish Square, on Monday, December 7th, 1925, with the President (Mr. HAROLD CHAPMAN) in the chair.

The minutes of the last meeting were read and confirmed.

The following candidates, approved by the Council, were elected to membership by show of hands :—

Miss A. TOBIAS, L.D.S.R.C.S.Eng., 42, Victoria Park Road, E.9.
ALFRED PAIN, L.D.S., M.R.C.S.Eng., L.R.C.P.Lond., 17, Earl's Avenue, Folkestone.

E. G. LANE, L.D.S. Victoria, B.D.Sc. Melbourne, D.D.S. Penn., 90, Park Street, London, W.

W. E. REVILL, L.D.S.R.C.S.Eng., 202, High Street, East Ham, E.6.

The PRESIDENT stated that no further nominations for Officers and Councillors had been received, and therefore he declared elected the following nominated by the Council :—

<i>President</i>	..	..	..	Mr. G. F. CALE-MATTHEWS
<i>Immediate Past President</i>	..	..	..	Mr. HAROLD CHAPMAN
<i>Vice-Presidents</i>	..	..	..	Mr. H. C. HIGHTON
				Mr. B. MAXWELL STEPHENS
				Mr. A. T. PITTS
<i>Secretary</i>	..	..	..	Mr. A. L. PACKHAM
<i>Treasurer</i>	..	..	..	Mr. W. OVEY
<i>Curator</i>	..	..	..	Mr. B. MAXWELL STEPHENS
<i>Librarian</i>	..	..	..	Mr. BERTRAM SAMUEL
<i>Editor</i>	..	..	..	Mr. CARL SCHELLING
<i>Councillors</i>	..	..	..	Mr. H. E. MARSH
				Mr. H. G. WATKIN
				Mr. J. B. PARFITT

Messrs. L. F. FOURAKER and A. LIVINGSTON, after being proposed and seconded, were elected Auditors for the ensuing year.

HON. TREASURER'S REPORT.

Mr. W. OVEY read the Hon. Treasurer's report :—

I beg to report that the total income of the Society for the past year amounted to £201 os. 2d., of which £186 7s. 6d. represents members' subscriptions, £5 1s. 8d. interest on investments, and £9 11s. the proceeds of the sale of *Transactions* to non-members. The total expenditure has been £203 4s. 11d., of which £173 4s. 11d. has been for general purposes, and £30 placed to the credit of the Prize Fund. The sum of £10 10s. 6d. has been transferred to the Society's vested funds to bring them to a round figure. The Society has to its credit two hundred National Savings Certificates at a present value of £160, £55 on deposit allocated to the Prize Fund, and a cash balance of £27 os. 6½d.

BRITISH SOCIETY FOR THE STUDY OF ORTHODONTICS.

INCOME AND EXPENDITURE ACCOUNT, December 1st, 1924, to November 30th, 1925.

STATEMENT OF ACCOUNTS.

1923-1924.		INCOME.		1924-1925.		EXPENDITURE.		1924-1925.	
£	s. d.			£	s. d.			£	s. d.
49	18 0	To Balance at Bank ..	..	39	2 1	By Rent ..	..	15	15 0
1	5 11½	" " in hand ..	..	0	13 8½	" Extra Meeting ..	..	1	1 0
174	6 0	" Members' Subscriptions ..	..	186	7 6	" Epidiascope ..	..	6	6 0
5	16 2	" Interest on Investments ..	..	5	11 8	" Printing, General ..	..	36	9 7
—	—	" Sale of Transactions ..	..	9	11 0	" " Transactions ..	..	26	4 5
						" Education Report..	..	20	2 6
						" Reporting ..	..	22	1 0
						" Typing ..	..	3	0 9
						" Petty Cash ..	..	4	17 11
						" " (Patients' Fares)	..	3	9 0
						" Refunded Subscriptions ..	..	3	3 0
						" Library ..	..	0	6 9
						" Museum ..	..	8	1 6
						" Refreshments ..	..	11	16 6
						" Japanese Relief Fund ..	..	—	—
						" Honoraria, Miss Cumby ..	..	5	5 0
						" Dr. West ..	..	5	5 0
						" Transferred to Prize Fund ..	..	30	0 0
						" " Reserve Fund 10 0 0 }	..	10	10 6
						" Brokerage and Stamp 0 10 6 }	..	0	10 6
						Balance ..		213 15 5	
								27 0 6½	
								£240 15 11½	

We have examined the Books and Vouchers and find the above Statement of Accounts to be correct.

W. A. BULLEID.
J. N. STRICKLAND.
Hon. Auditors.

The Medical Society has found it necessary to increase our rent to £25 per annum, but as this includes the use of the epidiascope at all meetings the net increase is only about £3.

Mr. F. B. BULL proposed and Mr. G. NORTHCROFT seconded the adoption of the report, which was agreed to.

HON. CURATOR'S REPORT.

Mr. MAXWELL STEPHENS read the Curator's report:—

Mr. President and Gentlemen,—There has been only a small increase in the number of specimens in the museum. Messrs. Bocquet Bull, Cale-Matthews and Mayer have made presentations.

A "Camera Lucida" has been purchased by the Council.

The Assistant Curator, Miss George, has had this in use while making measurements of models sent as instances of normal occlusion.

The Secretary in his report has alluded to the expected influx of specimens and the means which, through our President, Mr. Harold Chapman, is being found to extend the accommodation for them.

He is giving us a cabinet which will be uniform in principle with the one Mr. Lewin Payne gave us, and will consist of specimen drawers permitting the display at our meetings of any individual group of objects from the museum.

Both cabinets will stand in a room on the ground floor of this building and will, we hope, be accessible to members or students also at times other than when our meetings are being held.

Mr. A. T. PITTS proposed and Mr. H. G. WATKIN seconded its adoption, and this was agreed to.

HON. LIBRARIAN'S REPORT.

Mr. B. SAMUEL read the Hon. Librarian's report:—

During the current year some additions have been made to the Library, and *Transactions* of our own and other societies have been re-bound. It is observed that the members are making an increasing use of the Society's books.

It is interesting to note that the Society's own *Transactions* are greatly valued, both at home and abroad, and that ten volumes have recently been disposed of at the price of one guinea a volume.

Mr. H. G. WATKIN proposed, and Mr. F. B. BULL seconded its adoption, and this was agreed to.

HON. SECRETARY'S REPORT.

Mr. A. L. PACKHAM read the Hon. Secretary's report:—

Eight meetings of the Society have been held during the year, seven of them on the usual dates, and an additional one in June. The latter was addressed by Dr. Merchon, of Philadelphia. The attendance at the meetings this year has been very good.

The presidential address took the form of a paper, entitled "An Investigation into the Etiology of Malocclusion." The distinguished visitors who have read papers this year are Dr. West, of Dublin, and Dr. Quintero, of Lyon. Papers have been read by Mr. Steadman, Mr. Pritchard, and Mr. and Mrs. Lindsay. A large number of short communications have been presented. The usual demonstration meeting was held, and once again proved to be much appreciated. During the year twenty-five members have been elected, and one has resigned. This is against twelve members elected and three resigned in the preceding year. The total membership is now 194.

Your Council has dealt with the following business during 1925:—

(1) The Committee of Nomenclature has resumed its activities, and is now at work upon the problem of the standardisation of orthodontic nomenclature.

(2) The Education Committee has completed its work, and its report has been circulated to all members.

(3) The Council, acting on the report of the Investigations Committee, has invited members to fill up and send to the Society forms designed to give the detailed history of two or three members of one

family. It must be mentioned with regret that very few of these forms have so far been received.

(4) A Committee has been considering the orthodontic treatment of school children in relation to the elementary school service. This matter, for the moment, lies upon the table.

(5) A clinic working with the James Mackenzie Institute for Clinical Research, St. Andrews, which records the detailed history of infants and young children, has been approached. The Council considered that very valuable information regarding the etiology of malocclusion might be obtained if models of the mouths of these children could be taken and recorded with the histories. This matter is being proceeded with.

(6) The Council has appointed two assistants to the Curator and Librarian. These officers do not hold a seat on the Council. Miss V. H. George and now Mr. L. F. Fouraker have kindly consented to assume these duties. It is hoped that arrangements may soon be made whereby the library and museum will be opened for members prior to the meeting.

(7) It was reported by the Council last year that the first International Orthodontic Congress would be held in New York in August, 1926, and that the Society had been invited to become a component Society of it. This invitation has now been accepted, and officers to represent the Society at the Congress have been elected.

(8) The B.D.A. have kindly allowed the Society to approach those gentlemen who loaned specimens to the Association's museum at the annual general meeting held at Whitsuntide last, with a view to finding out whether they would be willing to loan or give duplicate models to this Society. A large number of favourable replies have been received. The number of models would be large, and the accommodation of them provided the chief obstacle to acceptance of the kind offers received. To meet this difficulty a very generous offer from this year's President, Mr. Harold Chapman, of an additional museum cabinet, has been gratefully accepted by the Council.

May I express my appreciation of the support and much help extended to me in this my first year of office as Secretary to the Society.

Mr. G. NORTHCROFT proposed that it be adopted, subject to the alteration that the International Dental Congress would be held in August and not in June, and that the reference to St. Andrew's University should be to the James Mackenzie Institute for Clinical Research, St. Andrews.

Mr. PITTS seconded, and this was agreed to.

The PRESIDENT announced that the French Orthodontic Society had invited the British Society to send a delegate to their meeting at Marseilles on January 8th, 9th, and 10th. The Hon. Secretary would be glad to hear of any member who might be going to that meeting.

VALEDICTORY ADDRESS BY MR. HAROLD CHAPMAN.

The fact that I have had to consider the presentation of a valedictory address has drawn my attention to the terminological inexactitude by which I have described the retiring President's remarks for a number of years. During this very session I have seen opposite to me a number of my predecessors, all of whom have read valedictory addresses. Had their addresses been read to this chair I should have been deprived of a theme. I have no wish to read a valedictory address to a chair, which by its cast of countenance could not signify approval or disapproval; or even complete indifference, by nodding its head in silent contempt. Rather would I make to you a valedictory appeal.

Your officers, by their reports, have indicated the scope of the Society's work and the directions of its activities; in addition to them we are greatly indebted to others whose names appear on the programme and the agenda papers; we regret that Messrs. Friel, McKeag and Northcroft retire from the Council.

Our activities are only possible by the earnestness of the members

of the Society, both in the Council and out of it. Without any invidiousness I may remind you that no one could exhibit a greater desire for the success of the Society than our Secretary, who already has next year's programme well in hand; that no one could exhibit a greater desire for the financial soundness of the Society than our Treasurer, who tells the Council that we have not the money for this or that, and later confides to me that he has made provision for the prizes (papers for this must be received a year hence), and, in addition, has put away a nest-egg; that no one could exhibit a greater desire for the welfare of the museum than our Curator, on whose initiative we look forward to a display of a part of our collection each time we meet here. The increase in our membership cannot be but gratifying, likewise the attendance at the meetings.

For these reasons I renew an old appeal—there are new ears to hear and new eyes to read—but this time I do so by means of a quotation.

In a recent number of the *Bulletin* of the Pacific Coast Society of Orthodontists reference is made to the newly founded Chicago Association of Orthodontists, whose objects are set out thus:—

- (1) The promotion of fraternal and professional ideals;
- (2) The study and advancement of orthodontics; and
- (3) The improvement of orthodontic practice.

Editorial comment on these objects is made as follows:—

“One might say these are the objects of all orthodontic societies. We may take it for granted they are being promoted in every society, but the question is, how and by whom? Ordinarily, by a small portion of the membership and in them it may be said is the strength of the society. It is well that every member of an orthodontic society should hold uppermost in mind these objects, for to be a member of an orthodontic society, in *fact* as well as in name, is to promote such objects individually and in association.”

I would add that in *this* Society these objects should be the aim of the entire membership, and that each one of us, individually and collectively, should work for these objects.

This is my valedictory appeal—an appeal to *every* member to take a part in the work of the Society. In the past a number of eminent persons, not members of the Society, have honoured it with papers and I hope we shall continue to welcome such warmly. Nevertheless, let us not forget that the gods help those who help themselves, and the Society looks to each one of you, ladies and gentlemen, to help it. Our Secretary is always glad to hear from you; he makes many personal appeals, but cannot write to all. So help him lighten his burden by offering your assistance in any way that appeals to you and remember that he is always hungry for papers and other communications, even though a place on the agenda may not be immediately vacant.

I would remind you also that one of the functions of the Council is to receive suggestions from the members. A book exists for this, but probably a letter may be found more convenient. May my appeal be not in vain.

To this chair my valedictory words are that it has been a real pleasure to have been in proximity to it for many years; it is but in the nature of things that I surrender it for one more plebeian, yet it does not—this to the chair alone—come to pass without a sigh. However, my dear chair, I look forward to beholding you from the other side of the rostrum for many more years.

To you, ladies and gentlemen, my valedictory words are those of heartfelt thanks for your great confidence and support, which I know you will extend to my friend and successor, Mr. Cale-Matthews. I regret to tell you that illness prevents his presence here this evening and deprives me of the pleasure of personally inducting him to this high office.

ORTHODONTICS FOR THE MASSES.

By F. ST. J. STEADMAN, L.D.S., M.R.C.S., L.R.C.P.

WHEN your President in December last year asked me to read a paper I told him that I could not get the work finished before the middle of next year at the earliest. He, however, overcame my scruples in this direction with his usual tact, and I agreed to read it to-night. This, however, has only given me just a year to collect the cases which I wanted to show you.

It was my hope and intention to give you the completed models, before and after treatment, of at least fifty cases. I have not been able in the time, however, to do this, and I have therefore been obliged to make up the number with a few cases which are not quite complete. The difficulty in collecting fifty cases in any year is great because many of these are hospital patients, and I have been unable—even by the offering of bribes!—to induce many of the cases to come up again to have their final models taken. I hope, therefore, you will forgive my inclusion of some cases which are not quite complete.

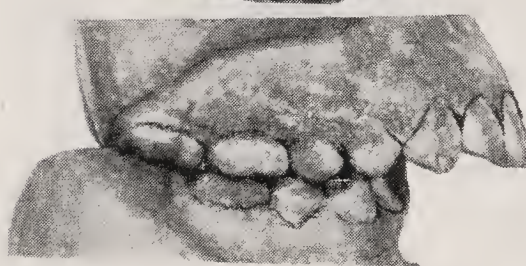
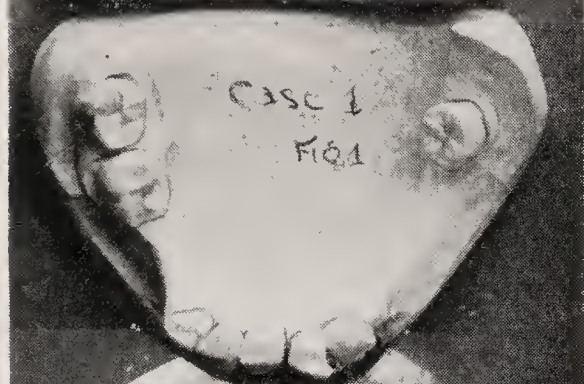
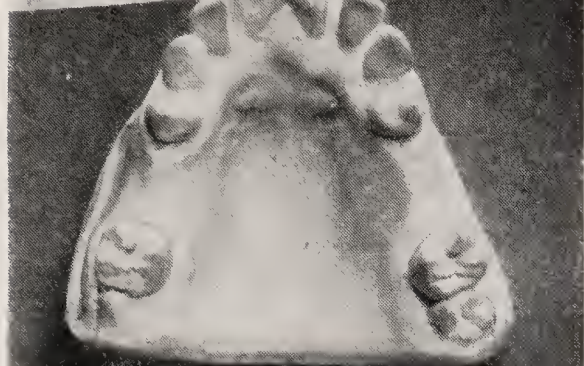
I wish to express my indebtedness to the late Mr. F. Butterworth and to his assistants who carried on the work after his death, for the preparation of the photographic slides.

THE IMPORTANCE OF ORTHODONTIC TREATMENT.

To emphasise before such a Society as this the importance of the treatment of malocclusion is very much like carrying coals to Newcastle. Nevertheless, I want to say a word about this. I would like to remind you—unnecessary though it is—that orthodontic treatment is not a mere luxury. The effect upon the individual of pronounced malocclusion may be far-reaching. In fact, it is not too much to say that it may completely spoil the life of the unfortunate sufferer, not only from the fact that the appearance of the individual may be unsightly, but because, owing to the malocclusion, that bugbear of civilisation—periodontal disease—is more likely to develop in a case of malocclusion than in normal mouths.

We had a most excellent paper two meetings ago by Mr. Pritchard, which emphasised this point. We all know those cases of marked superior protrusion when the upper incisors project beyond the lower lip, exposing the gum round the necks of these teeth, and how most of these cases sooner or later develop gingivitis, which progresses to true periodontal disease with its resultant loss of health. This loss of health is liable in both men and women to affect their wage-earning capacity and, in the case of women, it is also liable adversely to influence their probability of marriage.

Case 1 illustrates these points very well. The models shown are those of a lady who has a marked superior protrusion. Unfortunately the models which I originally took when she was about twenty-one were lost during my absence at the war. The models before you show the condition after the loss of several teeth. Bad though the condition is I regret to say that this was not an untreated case. She went when she was aged about 12 or 13 to one of our most distinguished dental surgeons of that day, who has since passed to his final rest. This man attempted to force back the incisor teeth without making room by the removal of the first premolars. He did succeed in getting the teeth back to a certain extent, but as soon as the retention plate was left off—after being worn I believe for three or four years—the teeth quickly returned to their original position. I believe some eighty guineas were spent by the child's parents for this treatment, which turned out to be completely useless. At about the age of 19 the girl became extraordinarily morbid and sensitive about her condition, owing to the unsightly appearance of her teeth. She went to another dentist who at first said nothing could be done, as she was too old. She, however, persuaded him—one might almost say with tears in her eyes—to do something, but she laid down the condition that any appliance put in should not show. Against his better judgment he fixed a gold band round the right upper molar, to which was attached a lingual gold wire, which was carried forward to behind the upper front teeth. He fixed the end of the wire to the back of the teeth by drilling a hole through the enamel and cementing it in position. The wire contained a loop to give it an additional spring; the object was that the wire should bring the incisors back. As a matter of fact, it completely failed in its object. It did not retract the teeth in the slightest degree, but it was forced up against the gum margins during mastication, and when I saw the patient just after I qualified, in the year 1902, I found that this wire had become completely buried in some places underneath the gum surface, and the parts of the wire that were not buried were literally bathed in a considerable amount of pus. The gold band round the upper molar tooth had been driven deeply into the periodontal membrane, and this tooth was also bathed in pus in consequence. I immediately removed the appliance, which was obviously doing far more harm than good. So greatly were these teeth damaged, and so deep were the pockets round them that I very reluctantly advised their removal. This, however, the patient was very unwilling to have done, and I had a consultation with another dental surgeon high up in the profession who, in view of the strong opposition on the part of the patient to extraction of the teeth, recommended that we should attempt treatment; but during the years that followed I saw the septic condition of those teeth gradually spread round the mouth. The damaged teeth and the gums around became so inflamed and tender that she did not use this (the right) side for mastication, and the lower teeth soon became septic also, and gradually the condition spread all round the mouth. By this time she had become so morbidly sensitive about the condition that even her nearest relatives and best friends dare not mention the condition to her. As time went on she developed abscesses round one tooth after another, until, at the age of forty-six



or so, the models were as you see. Her breath was then so offensive that it was unpleasant to be near her, and all through her life her health has been very poor, which was undoubtedly due to a septic absorption. I have good reason for saying that I believe she lost her chance of marriage through these unsightly teeth.

This morbid sensitiveness to the unsightly appearance of the teeth is well worth noting, as I believe it is not uncommon, especially in women. It is not too much to say that this patient's life has been spoiled by her malocclusion.

It is interesting to note in passing that this condition appeared to develop about the age of 13 or 14 or so ; that is to say, about the time of the eruption of the permanent canines, as the next slide shows that at the age of 8 she had no sign of any protrusion. The upper lip in childhood does not appear to be short, so that a short upper lip does not seem to have been the cause of the trouble in the first instance. I have been unable to satisfy myself as to the cause of the malocclusion, as there is no history whatever of adenoids, but, as I say, I did not see the patient until she was about 22 years of age.

Second case (Fig. 2) is somewhat similar to the last. She is the child of quite poor parents and could afford very little in the way of dental fees. It is certainly no fault of the mother that at the age of 15 the girl's mouth was in the condition shown in the models. She had taken the patient to two private dentists, one of whom said that the condition would eventually correct itself and the other had said that nothing could be done. In view of this the mother had taken the girl to one of our big hospitals, where she was seen, I understand, by a member of the staff, who attempted—as in the previous case—to force back the incisors without making room, and, at the age of 15, she came under my care. I removed the two first premolars and endeavoured to retract the canines, but the condition, although it is improved, is by no means satisfactory. When the case is allowed to get into such a condition the enormous growth of alveolar bone which seems to push the upper lip up out of the way makes treatment difficult, and the result is generally unsatisfactory.

It is an unfortunate fact that quite a number of these and other cases of marked malocclusion are being allowed to develop under the very eyes of our profession.

Quite a number of men tell the parents of these unfortunate patients that the conditions will right themselves. The reasons for this appear to be two : the economic aspect and the lack of training of dental men in the science of orthodontia, conditions which are dealt with in the later part of this paper.

I am assuming that a poor person, man or woman, who has not quite the best set of teeth from an æsthetic point of view, but who nevertheless has a clean mouth, and with a good clear complexion of the skin due to robust health, is in a better position than some of those unfortunate patients who suffer from marked malocclusion and consequent periodontal disease with loss of health, and with dirty sallow complexions. Beauty and good appearance, after all, do not rest entirely upon the appearance of the teeth. There are other and even more important factors. I now propose to show cases before and after treatment.

These cases I have arranged into groups according to the teeth extracted.

Group I.—Extraction of the 1st Upper Premolars.—With or without the lower premolars or a lower incisor.

Group II.—Extraction of 2nd Premolars.—With or without the lower second premolars.

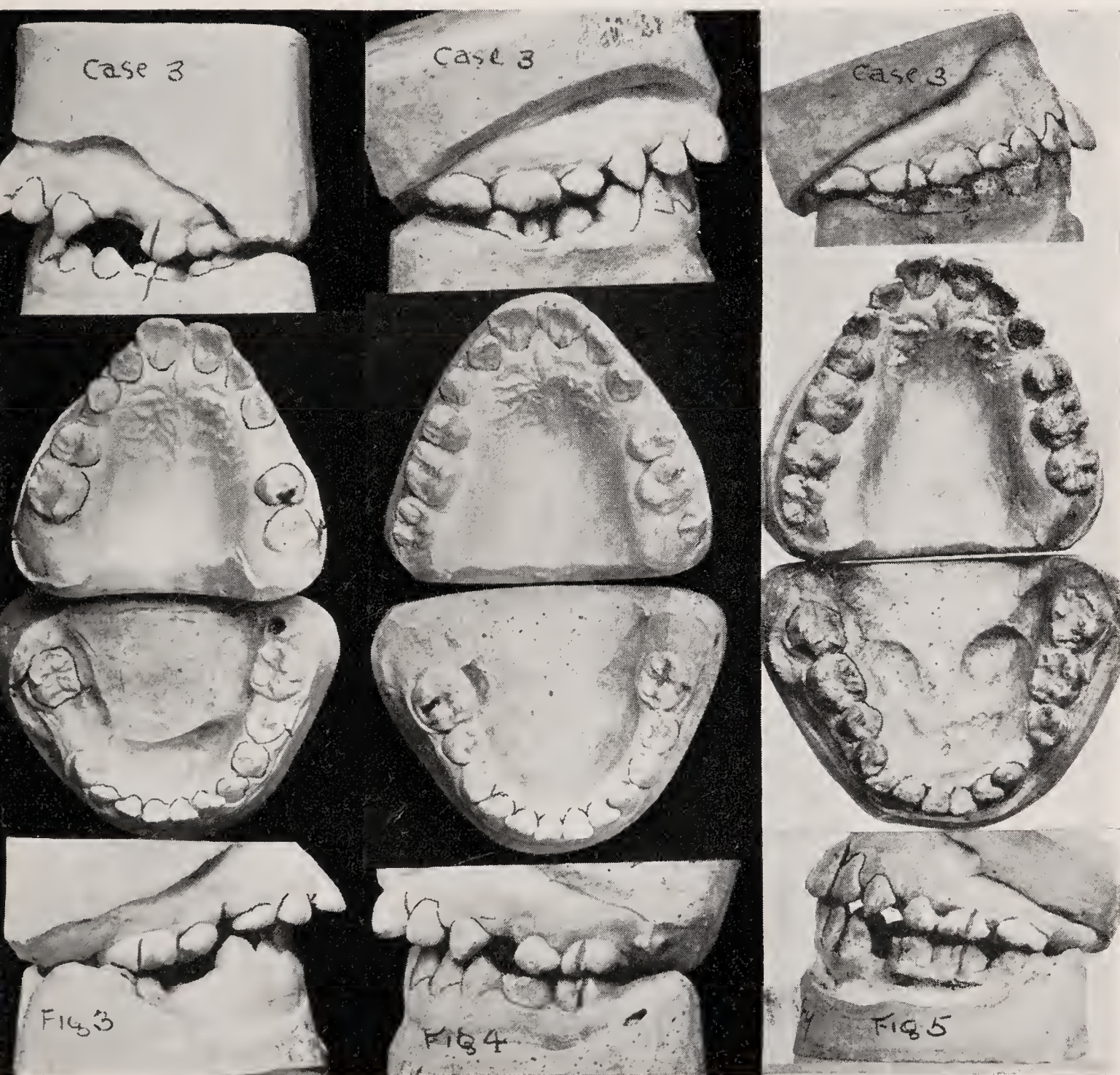
Group III.—Extraction of Upper Laterals.—With or without a lower incisor.

Group IV.—Asymmetrical Extractions.—Misplaced teeth.

Group V.—Extraction of the 1st Permanent Molars.

Group VI.—Extraction of Upper Canines.

A hundred lantern slides were then shown giving cases before and after treatment. Some of these cases are illustrated in this paper.



rtly after extraction of $\frac{4}{4}$ (unerupted). Four years later. Eleven years after extractions.

In the third case: a girl aged 10 (Figs. 3, 4, 5) I am unable to show you the original models because they were lost during my absence at the war. The models shown were, however, taken

shortly after the extraction of the first premolars at the age of 10 (September, 1908). The next models were taken four years later (September, 1912). You will see that the canine on the right side has dropped back, but there is still a space behind the left canine; the next models were taken in June, 1919, eleven years after the extractions. The left upper canine has dropped back still further and the gap is almost closed. The left lower premolar was lost from caries during the war. No appliance was used for either of these cases.

The fourth case (Fig. 6) shows the models of a girl aged 21, who had had all four premolars removed six years previously. The gentleman who removed these premolars is a dental surgeon at Cambridge, and I wrote to him for the original models, but unfortunately he had destroyed them. The photograph shows that the case cannot be regarded as a "mutilation."

The fifth case (Fig. 7) is that of a girl who had two first premolars removed for over-growing at the age of 10. I am unfortunately unable to show you the original models, as my house-surgeon, who removed the teeth, committed the orthodontic crime of omitting to take any. I show you also the models of her elder sister, Queenie. The two cases are very interesting to compare. Ruth had lost all her second deciduous molars at the age of 3 years, while her sister did not suffer from caries and shed her teeth in a normal way. The cause of the crowding in this case is quite clear, namely, the forward movement of the first permanent molars. I am convinced in my own mind that when this forward movement of the first permanent molars takes place as the result of premature extraction of the deciduous teeth, the best thing to do is to accept the fact that they are too far forward and to remove the first premolars. The result in this case I think you will agree is good both from the point of view of function and appearance. I have seen these cases wrongly treated as post-normal occlusion, and the lower jaw brought forward. This to my mind is quite wrong, because when such treatment is carried out you have every tooth in the head in the wrong position, whereas in the treatment shown there is the loss of two teeth; and six teeth, namely, the upper molars, are the only ones in a wrong position.

The sixth case (Figs. 8 and 9) is that of a poor and highly nervous delicate girl aged $7\frac{1}{2}$, brought to me by her doctor because she had been awake several nights with toothache. She was crying piteously when she was brought into my surgery, and it was quite obvious that I was unable to take models, but I removed the carious teeth—namely, the upper first deciduous molars and canines and the four lower deciduous molars (April 11th, 1923). At the same time I relieved the crowding of the lower incisors by the removal of the left lower central. The next models show the case exactly two years later, when the two first premolars were removed to make room for the canines. The final result of this case will, I think, be good.

The seventh case (Fig. 10) was that of a boy aged 12 years 4 months. There is post-normal occlusion with marked overlapping of the upper incisors and the upper canines were crowded completely out of the arch. The four first premolars were removed on June 25th, 1925, at a too recent date to make it worth while showing you the

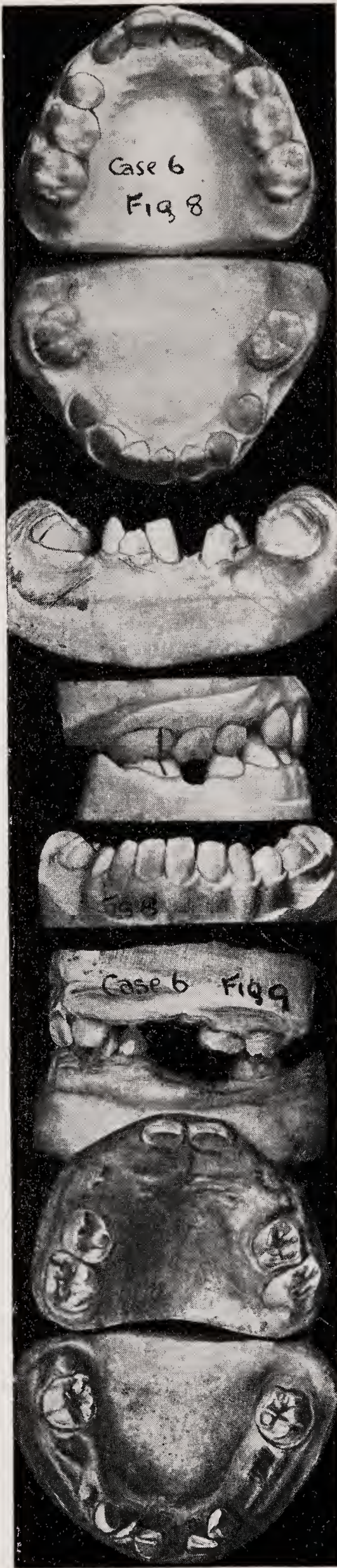
present condition. The canines are coming into the arch quite well. The post-normal occlusion and the overlap are left untreated. In cases of this kind where the occlusion is good it is sometimes good treatment to remove the canines, especially in cases where the canines are badly placed.



R. C.
after
treatment.

Q. C.

April, 1925.



Just after
extraction
of | 1
13 April, 1923,
age 7½ years.

April, 1925

April, 1925

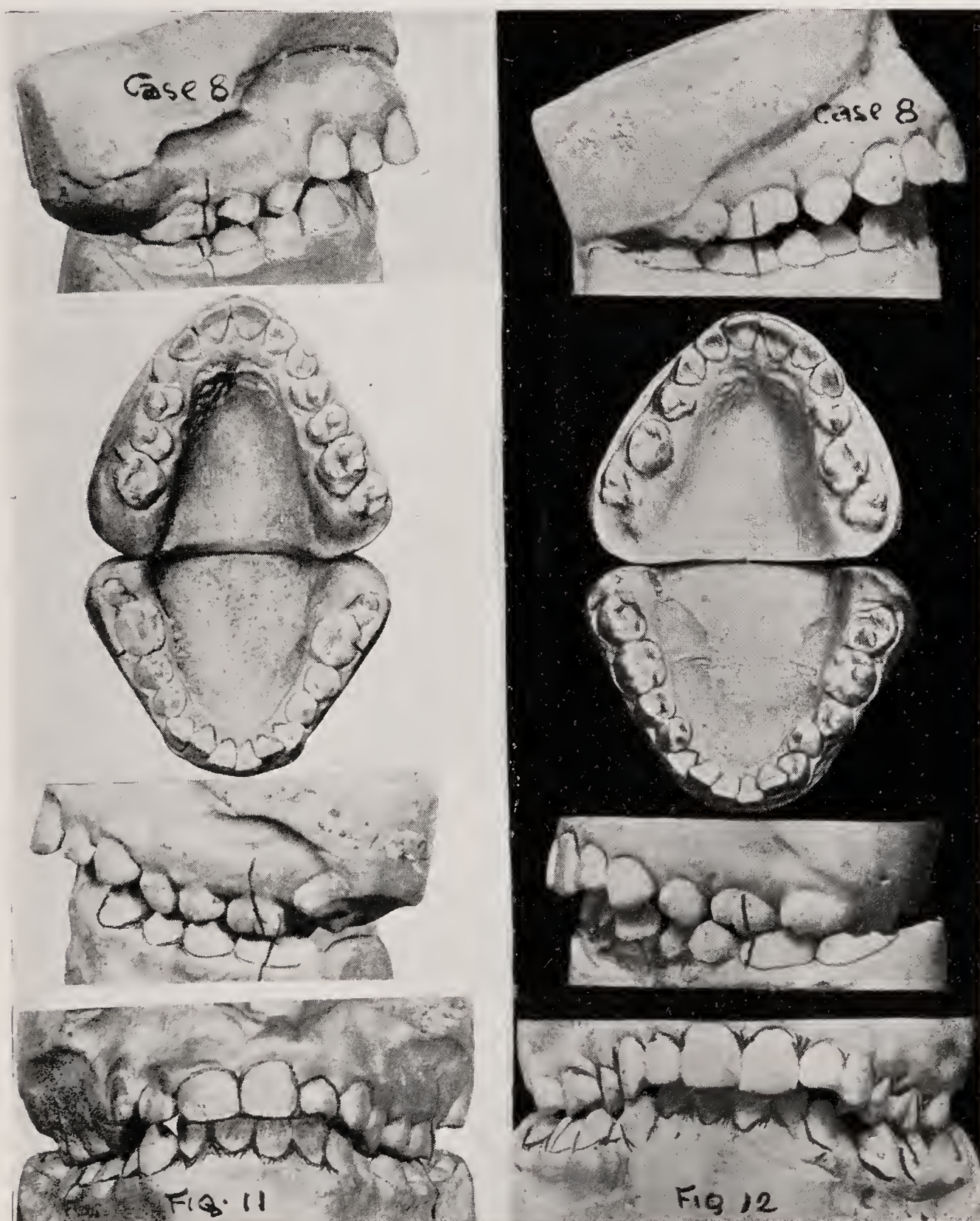
13 April, 1923,
a week after
extractions.
D.C. | CD
ED | 1 DE
Age 7½ years.



Before extraction $\frac{4 \mid 4}{4 \mid 4}$

Group II.—The Removal of the Second Premolars.

The eighth case (Fig. 11) is that of a girl aged 12. There was marked prominence of the upper incisors which were getting outside the upper lip. The second upper premolars were removed on March 8th, 1922. The next series of models (Fig. 12) are shown in this case two years and one month later. The occlusion on the left side is not yet quite good because the teeth have not yet settled down to the occlusion. I have seen the case quite recently and the occlusion is still improving.



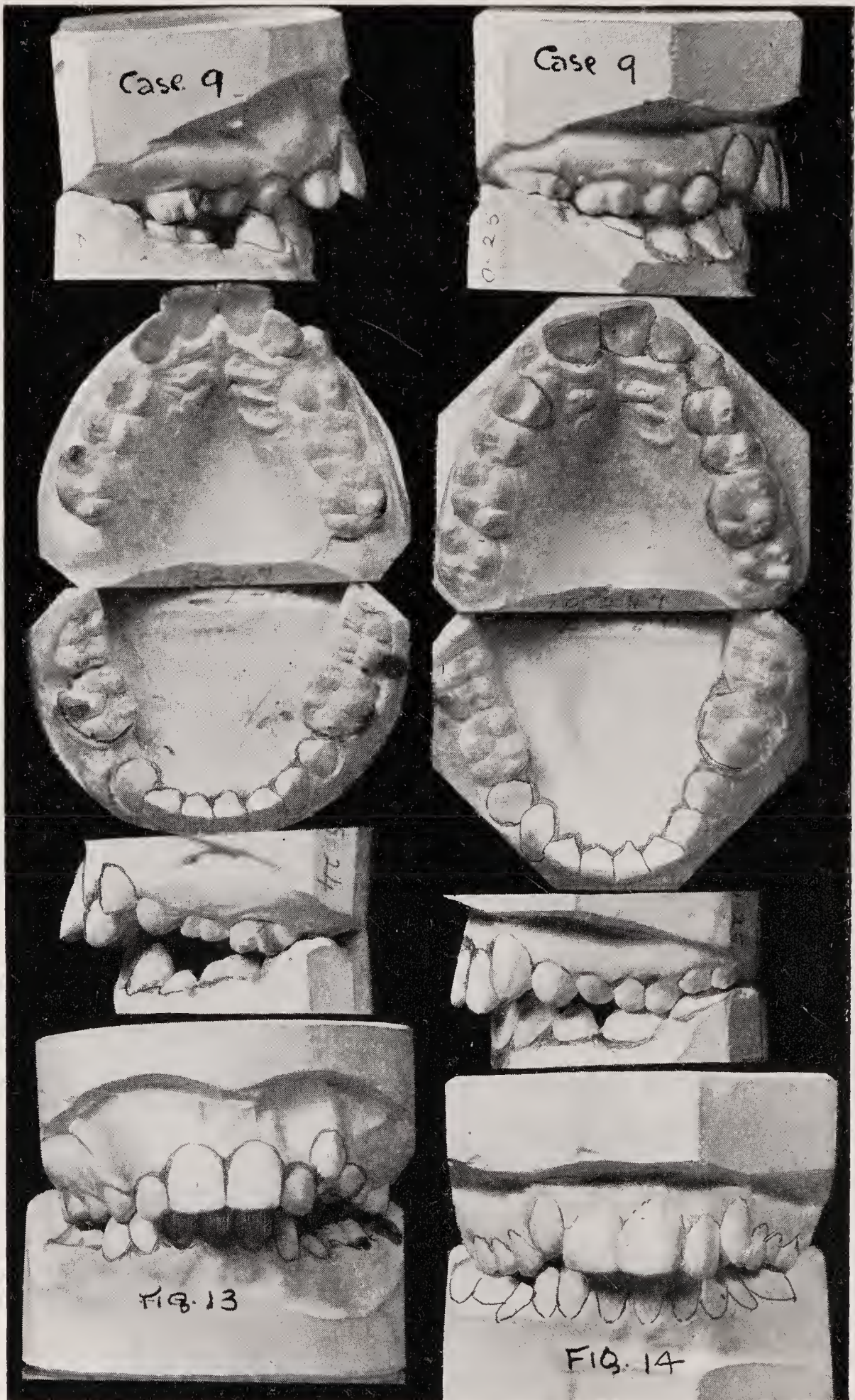
Before treatment of $\frac{5}{1} \mid \frac{5}{1}$

After treatment.

Group III.

In this group of cases are the extraction of laterals with or without the extraction of a lower incisor.

In the ninth case (Fig. 13) a girl aged 12, the right upper lateral, the left second deciduous molar was removed, together with the two lower first premolars to relieve the mandibular crowding. The next models (Fig. 14) were taken five months later. The result in this case is by no means perfect, but there is a marked improvement on the original condition.



Before extraction of

2	E
4	4

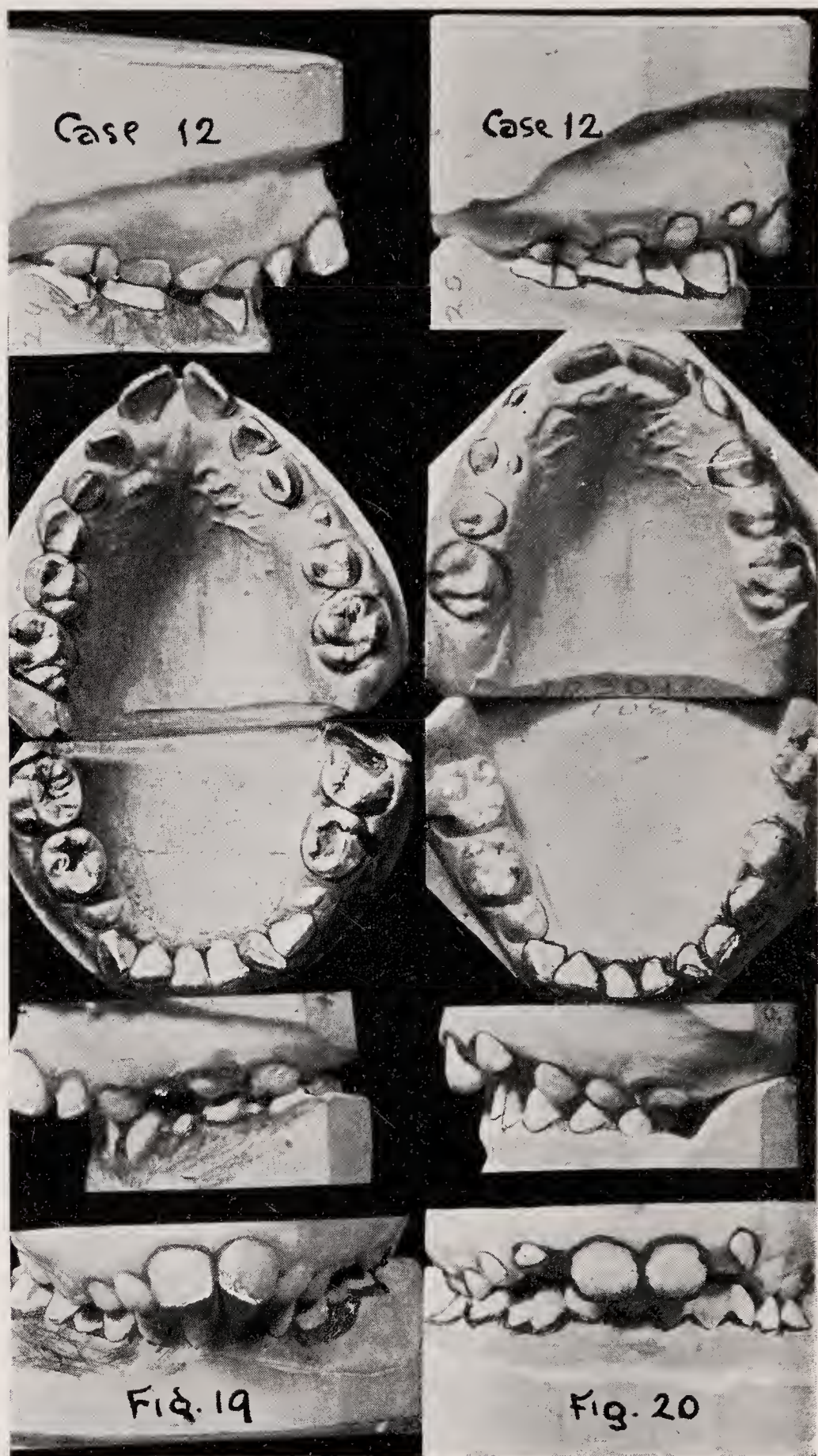
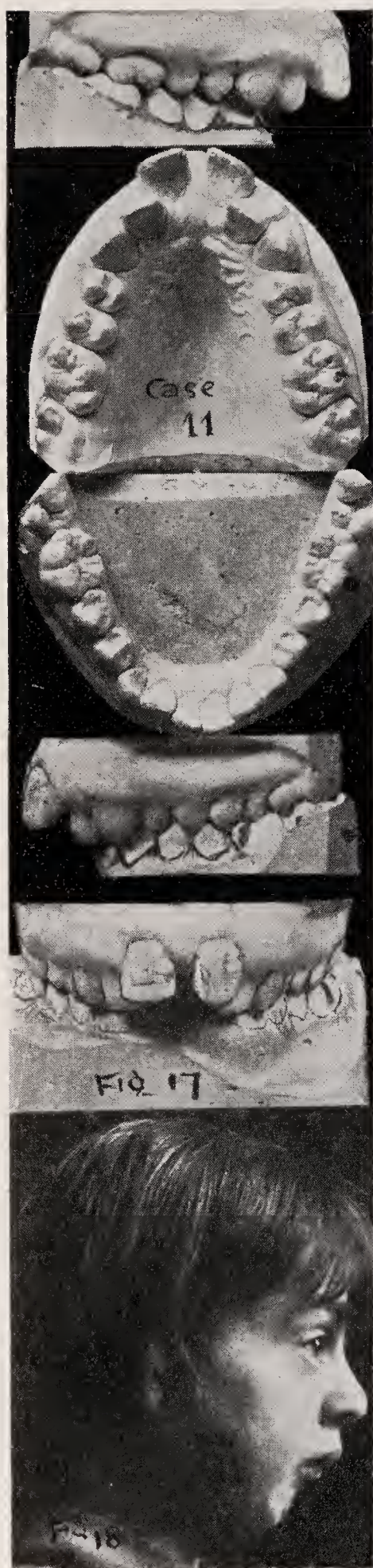


Before.

After.

In the tenth case (Figs. 15 and 16), a boy aged $11\frac{1}{2}$, there is marked overcrowding, and the two upper lateral incisors and the two lower central incisors were removed. The result shown in the next series of models is by no means perfect, but I think you will agree that the treatment carried out has given him a functional mouth, and is far better than leaving the case severely alone.

In the eleventh case (Figs. 17 and 18), a girl of 13, there is marked superior protrusion of the upper central incisor teeth, accompanied by a marked degree of post-normal occlusion ; the two upper laterals were removed and the upper incisors are gradually coming up with the pressure of the lips. The post-normal occlusion was left untreated, as the patient was exceedingly poor. She could not afford even the fares up to the hospital.



In the twelfth case (Figs. 19 and 20), a girl aged $11\frac{1}{2}$, the treatment was the same; the two upper laterals were removed and the incisors are coming in through the pressure of the lips. It is a curious fact that the relief of crowding by the removal of laterals in the upper incisor region frequently gives an appearance very much as if the arch had been expanded. This is well shown in the models of the next case.

In Case 13, a boy aged $12\frac{1}{2}$ (Figs. 21 and 22) we have a supernumerary incisor in the upper region. This was removed together with the lower permanent six-year-old molars; the molars being chosen in this case because of the marked caries and hopeless condition of the left one. Here, too, the arch appears as though it had been expanded.

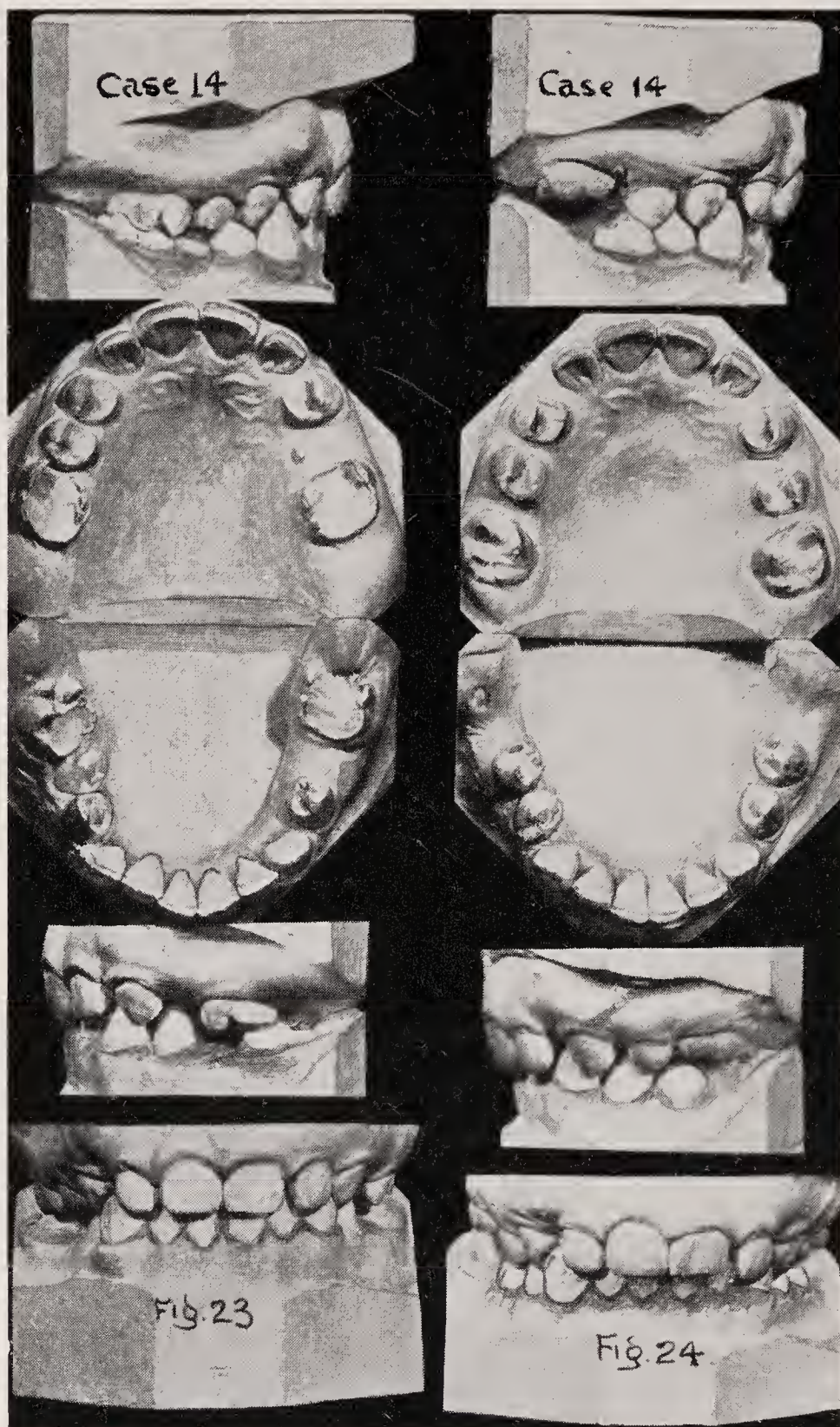


Group IV.

In this group of cases I place those in which asymmetrical extractions have been carried out.

Group V.

Fourteenth case (Fig. 23), that of a boy aged 10, with marked overcrowding in the incisor region, is complicated by advanced caries in the first permanent molars. Extraction of these teeth alone will not relieve crowding in the front of the mouth unless the second permanent molars are held back by an appliance.



His four first permanent molars were removed on April 8th, 1925. The next models (Fig. 24), taken five months later, show that the second upper molars have come forward as was expected without relieving the anterior crowding. It is now proposed to complete the case by removing the upper laterals.

Such, then, is the result of treatment by extraction. I do not claim that the result obtained in every case is ideal. But I do claim that it is much better to treat these cases as they have been treated than to leave them alone. The majority of them have been treated in one visit and without any orthodontic appliance whatsoever. I feel that, considering the facts of which we are all aware, of the large number of cases being left entirely untreated owing to lack of means on the part of the patient and lack of time on the part

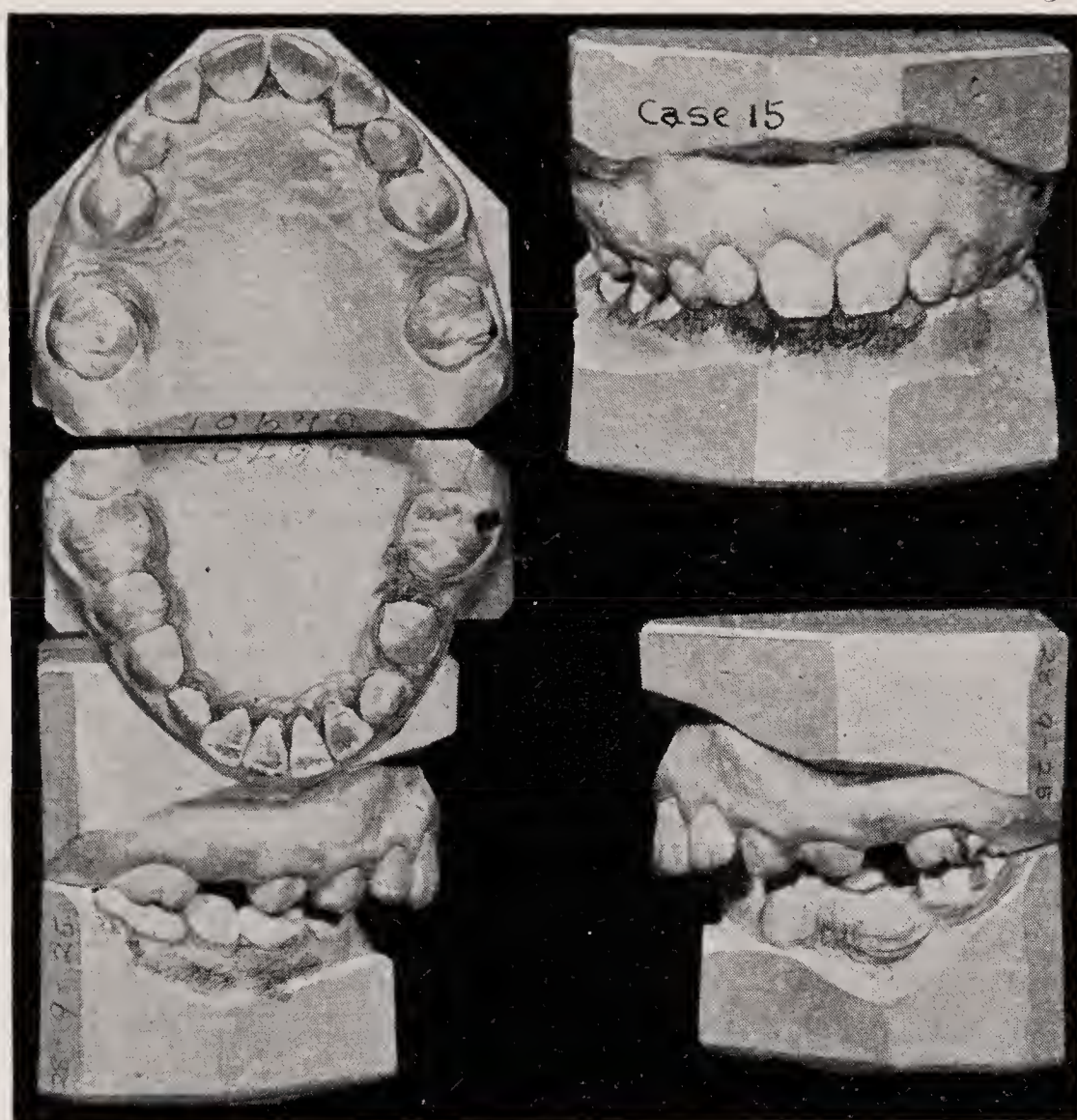


Fig. 25.

of the profession, this Society ought to take up the serious study of these cases as we have already taken up those of the more fortunately situated children whose parents can afford to pay. This treatment by extraction is being carried out by a large number of dental practitioners, many of whom are not only not getting the best results obtainable by this method, but are, in many instances, getting results which are positively disastrous, as the wrong teeth are being removed, to say nothing of those cases in which treatment by extraction is contra-indicated altogether. This Society ought to be able to give a lead as to what cases can be treated with advantage by extraction and what cases must not be so treated, and offer the men doing the work some guide as to what teeth may be removed with advantage. The need is urgent. Indeed, I do not think there is a greater need in any branch of our profession. It has recently fallen to the lot of Mr. Norman G. Bennett and myself to examine some senior hospital students for the London Bursary Scholarship. We gave them the case shown (Fig. 25). It was a clear case of post-normal occlusion, and the treatment

required must be obvious to all of you in this Society—namely, a slight expansion of the upper arch with a bringing forward of the lower jaw, yet ten out of twelve candidates diagnosed the case as superior protrusion, and no less than eight of them advocated the extraction of the two first upper premolars. Worse treatment than this would be difficult to imagine. It is quite clear to all of you, I feel sure, that the removal of any teeth in this case would be pernicious and would mutilate the patient so severely that it would be difficult or impossible after such extractions to make a good result of it. I feel that we ought not to neglect the treatment by extraction as we have hitherto done, especially when we realise that a simple solution such as this is all that a great number of patients can afford.

(I) THE ECONOMIC ASPECT.

I think, if you will forgive me saying so, the means of the patients to pay adequate fees for the treatment has not been sufficiently considered by this Society in the past. Looking through the papers read before us since 1916 the general trend of treatment has been of a highly complicated character. As an instance I will quote that very excellent paper which we heard at our last meeting. It is quite clear that the prolonged and complicated treatment which was mentioned in that paper means a very considerable cost to the parents—a cost which is in the majority of cases utterly beyond their means.

In my South London practice I see in the course of a year a large number of children, many of them suffering from malocclusion. I point out the condition to the parents, but if I suggest a fee of ten guineas or even five guineas I frequently find that I am not asked to carry out the treatment, and when the child comes up again in six months or so for the treatment of an aching tooth, I ask why nothing has been done, the answer is all too frequently that they cannot afford the expense. This is in my opinion the chief reason why it is that we have such a large number of children who, in spite of regular attendance to the dentist, are being allowed to develop marked malocclusion.

I have obtained the following figures* showing the incomes of the people of Great Britain ; Tables I and II show how the national wealth is distributed :—

TABLE I.—SHOWING DISTRIBUTION OF GROSS AND NET TAX-FREE INCOME, IN 1919-20.

Income.	Number of Incomes.	“ Actual ” Income. Millions.	Income Tax and Super-Tax. Millions.	Net Income after pay- ing tax. Millions.	Average “ Actual ” Income per person.	Average net in- come after deduction of taxes.
£		£	£	£	£	£
130-160	3,490,000	489	2.3	487	140	139
160-200	2,031,400	355	4.1	351	175	173
200-400	1,535,600	402	15.4	387	262	252
400-1,000	510,500	307	38.1	269	600	530
1,000-2,000	142,900	193	42.1	151	1,355	1,060
2,000-5,000	62,630	185	58.4	127	2,960	2,040
5,000-25,000	24,600	230	98.6	131	9,400	5,400
25,000-100,000	2,220	92	48.1	44	41,000	19,800
over 100,000	156	34	19.1	15	206,000	91,000
	7,800,000	£2,287	£326.2	£1,961		

* “ Wealth, Waste and Want.” Josiah Wedgwood, Junr., from the I.L.P.

This table does not tell what happened to over 13 million people with incomes under £130 a year.

The average income of this class was estimated in 1918-19 to be nearly £100 a year. (See above.)

TABLE II.—THE AVERAGE NET TAX-FREE INCOMES OF VARIOUS CLASSES IN 1919-20.

(1) *In Poverty*.—With incomes under £130, over 13,000,000 persons; average net income £100 or less. With incomes under £130-£160, over 3,500,000 persons; average net income £139 or less. Total with incomes under £160, 16,500,000 persons; average net income £108 or less.

The above represent four-fifths (78.5 per cent.) of the population.

(2) *In comparative Poverty*.—Incomes £160-£400, 3,567,000 persons, with average net income £205 a year. These represent about (17 per cent.) one-sixth of the population.

(3) *Well-to-do*.—Incomes £400-£2,000, 653,000 persons, with average net income (tax-free) £645 a year. These represent a little over 3 per cent. (one thirty-second) of the population.

(4) *Rich*.—Incomes £2,000-£10,000, 79,350 persons with average net tax-free income, £2,500 a year.

(5) *Very Rich*.—Incomes £10,000-£50,000, 9,600 persons, with average net tax-free income, £9,500 a year.

(6) *Millionaires*.—Incomes over £50,000 a year, 660 persons with average net tax-free income, £45,500 a year.

Those with incomes over £2,000 a year, in the last three classes, number 89,620, representing only one 230th of the people of the United Kingdom; but they enjoyed nearly one-tenth of the total net income, after all taxes had been paid!

TABLE III.—EXTRACT FROM TABLE 73. SUPER-TAX, 1920-21, 1921-22 AND 1922-23.

Class : Exceeding £	Class : Not exceeding £	Number of Persons.
2,000	2,500	20,153
2,500	3,000	14,144
3,000	4,000	16,654
4,000	5,000	9,255
5,000	6,000	5,970
6,000	7,000	4,051
7,000	8,000	2,790
8,000	10,000	3,648
10,000	15,000	4,244
15,000	20,000	1,748
20,000	25,000	904
25,000	30,000	498
30,000	40,000	563
40,000	50,000	284
50,000	75,000	276
75,000	100,000	119
100,000	—	134
		<hr/> 85,435 <hr/>

This Table III from the Sixty-seventh Report of the Commissioners of Inland Revenue shows that of the population of over 45,000,000 in this country only 85,435 are getting an income of over £2,000 a year.

These figures show, I think, that the number of people who can afford to pay a fee of, say, from fifty to a hundred guineas for prolonged and complicated orthodontic treatment are very limited in number, more especially during those years when their children are being educated—which are the very years during which this expense has to be met. Before the war parents with an income of £500 a year could just afford, if they exercised great care, to send one of their boys to a public school. This is not so now. It is not easy for parents even with an income of £1,000 a year to send two or three of their children to public schools. The fees of these schools have been increased very considerably during the last few years. From these considerations we see that a comparatively small number of the children of our land developing malocclusion can receive adequate treatment.

In my hospital practice I have been astonished at the number of people who cannot even afford their fares up to the hospital for a considerable number of visits, to say nothing of the mother's time, which is also an insuperable barrier in many cases. Quite a number of our cases there fail owing to these economic factors.

From the figures given it is impossible for me to arrive with any certainty at a conclusion as to the exact percentage of children whose parents can afford to pay big fees, but at a rough guess I should think it is not much higher than one in five hundred. This figure is of course merely a guess but it must contain a very considerable amount of truth and is the chief reason why so many cases remain untreated.

The remedy in this direction is not in sight in our generation or even in the next. Sir Josiah Stamp in a recent lecture at Cambridge showed that even if we had an equal distribution of wealth in this country the purchasing power of the average family would not be increased by more than five shillings a week in the first year, and that this figure would be smaller still in the second year. We are here, then, up against a very real and very practical difficulty.

LACK OF CO-OPERATION ON THE PART OF THE PARENTS.

Apart, however, from the economic factor there is another, smaller group of patients in whom complicated methods of treatment are contra-indicated; namely, those unfortunate children who possess careless and indifferent parents who will not assist them to keep their appliances clean. I have upon more than one occasion had either to withdraw from a case altogether or to simplify the case by extraction, because, owing to the dirty state in which the appliance and the mouth generally were being kept, the treatment was doing more harm than good.

THE LACK OF SKILLED TRAINING ON THE PART OF THE PROFESSION.

But even if this great economic difficulty were overcome we have nothing like a sufficient number of trained dental surgeons able to carry out the highly specialised and difficult treatment such as has been advocated by the various papers read before our

Society in the past. The expenditure of time, even if they had the skill, would be an insuperable difficulty under the present conditions. It would mean that such a large proportion of the dental practitioners' time would be given to the treatment of difficult orthodontological cases that there would not be time enough for the other necessary dental work for the population as a whole. This lack of skill and training could be overcome in time, of course, but it would take at least ten or twenty years before we could get enough trained men for the work.

SIMPLIFIED TREATMENT.

Is there no way out of the impasse? Are we to continue to allow the great majority of our children to remain untreated?

We have, of course, the hospitals. A certain number are obtaining treatment there, but some eighteen months ago, when I had before me a young child who wanted quite a simple irregularity corrected, I was told that there was a waiting list of over 170 cases because there was no one available to carry out the necessary work. Many of these cases, when their turn eventually arrives, have waited so long that the condition—easy enough to remedy in the first instance—has become very much more difficult.

I think there is a remedy in certain cases—namely, the simplification of our methods. Quite a large percentage of the cases which come before us can be very considerably improved by the judicious use of the forceps. This, of course, does not apply to all of them by any means, and I confess that I can see no daylight for these. The time of the school clinics is fully occupied, and I see no way of obtaining the skilled assistance which many of these cases require even if the parents could afford the fee.

This treatment by extraction of teeth enables some of these cases to be successfully treated in a few seconds in a single visit.

For some reason or other this Society has given very little attention to this aspect of orthodontic treatment. We have hitherto had no paper upon the subject, and, indeed, treatment by extraction has been hardly mentioned. It was, however, mentioned in one paper read before us on February 9th, 1921, by Mr. Cale Matthews, who thoroughly condemned the method. He described it as: "The perniciously ignorant practice of extraction," and, later on in his paper, he stated that: "Under no circumstances were teeth removed to make room unless irreparable," and later, in another place, Mr. Matthews referred to cases treated by extractions as "mutilations," and one does get the impression that this condemnation is more or less supported by a number of our members. The only comment I wish to make is that if this teaching is correct we must realise that, for the reasons I have already given, only a very small number of our children can be treated, and that we are catering entirely for the rich while ignoring the poor.

Yet in the international meeting of the European Orthodontic Society in the spring of this year quite a number of experienced men frankly stated that having tried various methods they had come back to the extraction of teeth to make room in the mouth in a certain number of cases. It is an undeniable fact that a very large number of men in suburban and provincial practices are

treating cases by extraction. Very often the results of this treatment are indeed appalling. The wrong teeth are removed, and they are removed at the wrong time. Mr. Cale Matthews's condemnation of much of this treatment as pernicious and ignorant, and his description of some of these cases as mutilations, is undoubtedly just.

I have shown you some cases in which the main idea has been to correct the malocclusion in the speediest possible way on the grounds of economy; but at the same time I wish to make it clear that in some of these cases extraction is in my opinion the best method of treatment apart from economy. Many of these patients were so poor that they were unable to meet the expense of half a dozen visits to the hospital. In looking at them and in forming your judgment upon them I want you to bear this vital and important fact in mind, and, with great respect, I want you to dismiss from your minds—in some cases at any rate—the ideal. It is surely better to treat a large number of cases if by so doing we are really satisfied in our minds that we can improve them and yet without quite reaching the ideal, than to devote all our time to bring about a result in one case which we do regard as ideal. My chief concern in the treatment of these cases that I am about to show you was function. By that I mean fairly regular alignment of the teeth with a good working, but not necessarily an ideal occlusion. I do not like giving figures, but if you bear in mind that from the point of function I would give 90 per cent. of marks to the case, you will get some idea of what I mean. What does it matter, for example, to a British labourer or to a domestic servant whether they have a slight flattening of the upper lip due to the absence, for instance, of the canines, or that the centre should be slightly out to one side or the other? What does matter to these people very much is that they should have a working set of teeth which they can keep clean and which are not likely in themselves to give rise to periodontal disease.

DISCUSSION.

The PRESIDENT thought that the author had amply justified his choice of subject. He had shown a wonderful series of cases, and it must be agreed that in very many there was a marked improvement without the use of an appliance. The social aspects of the problem he had referred to were very important. Perhaps the problem had not attracted the attention it merits, but the Society had had a small committee to consider it, and the British Dental Association had also appointed a committee recently. The author had advanced the matter a stage further and had shown what could be done; he did not claim any finality, only that the members should give their considered opinion and so assist him in deciding what was the best treatment in some of these very difficult cases. Anyone who worked in any public institution had to adopt some method of treatment like that which the author had expounded; there was no other method except in a comparatively few cases. The matter was now open for discussion.

Mr. NORMAN G. BENNETT said that he had greatly enjoyed the racy paper, and the author's main contention about the children of the poor must, he thought, be accepted. If the financial aspect was taken into consideration it was necessary to extract the teeth of some of these children. A severe critic might say that it appeared to be better to do bad treatment than no treatment at all, but that would be an unkind way of putting it. It could not be considered bad

treatment if the extraction of certain teeth left the child with a better occlusion than before. Surely with these children it was better to do that than to do nothing at all. But putting aside the financial consideration for the moment, he had been perfectly convinced for many years that to describe every case of extraction as mutilation was absolutely absurd. He could not think that anybody who had seen the thousands of children in hospital as well as private practice that many of those present had seen, with badly undeveloped maxillæ and mandibles, in which the teeth were by no means small, could expect in such cases "the quart to go into the pint pot" with any approach to regularity and uniformity. As the author had rightly said, the point was that the right teeth should be extracted and at the right time. He wanted, however, to protest, not against what the author had said, but against a very frequent line of argument that was taken up in discussions on this point—that of putting extraction on the one side and treatment by appliances on the other, as if they were in any sense antagonistic. They were not antagonistic at all. At one extreme there were cases in which obviously no tooth should be extracted, and which should be dealt with entirely by appliances, and at the other end of the scale there were cases in which extraction was obviously called for, and in which, after extraction, no other treatment was required, and the case would cure itself. But in between these two extremes there were a very large number of cases in which extraction was necessary but in which treatment by appliances in addition was required in order to produce the best possible results. If these cases were not in the majority, they existed, at all events, in very considerable number. It was too often assumed that in cases in which extraction was a necessary part of the treatment, extraction was the only thing that needed to be done. The majority of cases in which extraction was required called for some form of orthodontic treatment to follow extraction. He noticed in the paper a reference to the extraction of the second premolars. In his view this was seldom justifiable for the relief of so-called crowding. Almost the only cases in which such extraction was justifiable were cases in which there was congenital absence of the opposing premolars. The paper was a very useful antidote to that idea of Orthodontics which consisted in making a lifework and hobby of treating a few children by very complicated appliances rather than in treating a considerable number by simpler means.

Mr. F. B. BULL thanked the author for an interesting paper. The majority of papers read before the Society for some time past had been what might be described as of the "high brow" type; the present author had come to the "common or garden" subject. From that point of view alone it was extremely valuable. To anybody attached to a large hospital where hundreds of patients came up for treatment every month without a penny in their possession, some of the children without even a mother to bring them, it was one of the greatest problems to know what to do in such cases. Further, the majority of the parents had probably no particular wish to have their children's mouths attended to, and any treatment which might be given was not followed up in the home; it was hopeless to think of using appliances in these children's mouths, in view of the ignorance of the parents and the conditions under which the children lived. Only the other day he saw a boy—a remarkable specimen of humanity—with a very dirty mouth—in fact he was dirty all over—and presenting a typical case in which nobody would dream of using any appliance. Extraction was the only course to adopt. They had to thank the author for "breaking the ice" with regard to this subject. He did not agree with the author's remark that an expensive appliance was wanted for the correction of overlapping upper incisors. It was obvious that the insertion of a bite-plate in the mouth would correct that abnormality. The question of the extraction of the first

permanent molars presented some difficulty, because in very many cases the first permanent molars were badly carious—upper and lower. It would be a very serious thing to sacrifice strong, healthy premolar teeth when behind these teeth one had various molars. The correct course might be to extract the molar teeth and prevent a backward movement of the premolars with some form of appliance, supposing one intended to use apparatus at all.

Mr. MAXWELL STEPHENS said in defence of the Society—if it needed any defence—that it was not quite so “high brow” as Mr. Bull had suggested. Although there had been no paper such as this before, there had always been in the discussions someone who had spoken about extraction. He thought one should in practice plead for catholicity in treatment, especially in view of the fact that the race was in such a state of transitional development. It was obvious that there were many faces which would not accommodate the great amount of tooth structure born into the mouth; in other cases there were too small teeth for the mouth.

Mr. ROBERT LINDSAY said that his one complaint against the author would be the title of his paper, if by implication he meant that those unfortunate people who paid supertax were to be denied common-sense orthodontic treatment. What Mr. Steadman had described would be beneficial to any patient who was given the treatment. There was some danger in talking of “Orthodontic treatment for the masses,” because in this matter of orthodontic treatment as in all dental treatment the first consideration was what was best for the patient. It was true that it might be necessary at times to modify treatment and to accept certain results on account of external circumstances, but that should not suggest to them that there was such a thing as orthodontic or any other dental treatment of “the masses” as opposed to the same treatment of “the classes.” He recalled some remarks of Mr. MacPherson Fisher of Dundee in 1901 when dealing with this very problem. Mr. Fisher spoke of a struggle for existence between individual teeth in the mouth, and he advocated at that time the relief of this struggle by judicious extraction. Mr. Fisher laid it down—probably nowadays the dictum would hardly be accepted—that the possession of twenty functioning teeth in the mouth was sufficient for any modern person, and his suggestion was that this should be the ideal of ordinary dental treatment. That might seem a little drastic, but possibly in considering this great question of the orthodontic treatment of elementary school-children it was not a bad ideal to put forward. Then, again, it must be remembered in considering this problem that they were not always to be confronted with lack of the necessary skill to treat, or the means of providing the necessary apparatus. He hoped that in the comparatively near future effective training in Orthodontics would be at the disposal of every dentist who made it his lifework to treat the teeth of children. The present financial depression would disappear in due course, and following its disappearance there would be a possibility, under enlightened local education authorities and under the stimulus of an enlightened Board of Education, of providing all over the country the necessary orthodontic treatment for school-children. Therefore he was inclined to modify the somewhat dark picture which Mr. Steadman had drawn of the future in this respect, and he could conceive nothing more appropriate than that the British Society for the Study of Orthodontics should take in hand this question of the orthodontic treatment of the British people. He thanked Mr. Steadman for indicating lines along which this might be done, and he was sure that the paper would influence the future study of this subject.

Mr. H. G. WATKIN, on the general question of extraction, did not think that the author had mentioned much about the extraction of canines. He had in mind a very successful case, that of a girl of 16 years of age, rather old for orthodontic treatment, where the canines

were high up in the arch, the upper centrals inside the bite, and by extracting the canines and widening the arch a little a very nice result was obtained. Another point in favour of extraction was that if judicious extraction brought about a good result no damage was being done to the remaining teeth, an eventuality which must not be overlooked in the use of some appliances.

Mr. J. H. BADCOCK said that the author had furnished a very brilliant example of common sense in Orthodontics, and he agreed with his general principles, though not always in detail. Some years ago he wrote a paper on the same subject for the Orthodontic Society of Liverpool, dealing with a great many of the points that Mr. Steadman had touched upon that evening. He entirely agreed with him that attention must be paid to the masses of the people who could not afford elaborate treatment, and who outnumbered very greatly those who could. In such cases second-best was very much better than nothing, if the best could not be achieved. He was in agreement with Mr. Watkin's remark about the extraction of canines. He had ventured to extract canines on many occasions, and did not think he had ever regretted it. In many cases in which the canines were not coming down in their correct position they might, he thought, be extracted and that such treatment was the shortest cut to a successful result. He thought that students should be taught more than they were at present—or at all events more than they were until recently—of the principles underlying treatment by extraction. In dealing with a hospital patient the first thing one had to think of was what teeth were to be removed. One would often be obliged to extract a second premolar where one would have preferred to extract a first premolar, because caries had obliged one to extract its opposite; and that applied all round the mouth. When, guided by the loss of their opposites, it had been decided what teeth to extract, one would be in a position to decide the mechanical treatment, if any, which it would be best to adopt. With a different class of patient the problem was, of course, rather different. The extraction of first molars often became a painful necessity by reason of caries. If these had to be extracted his own belief was that they should be extracted as early as possible and before the eruption of the second molars, supposing their extraction to be necessary simply because they were carious, and one was not attempting to correct irregularity by that means. There were a great many other points arising from the paper that might fittingly be discussed, but he would only thank Mr. Steadman for a paper which would be exceedingly valuable in calling attention to a very important problem.

Mr. J. LEWIN PAYNE wished to emphasise that the Society did represent a somewhat more catholic view of Orthodontics than one or two of the earlier speakers in the discussion had suggested. Most of the older members would realise that in the meetings of the Society Orthodontics had been discussed from all points of view. He wished only to add his thanks to the thanks of others to Mr. Steadman for bringing this question before the Society with such emphasis and clearness, and for showing definitely the means by which many patients might be helped without having to undergo a long process of mechanical treatment.

Mr. A. T. PITTS also congratulated Mr. Steadman on his subject and his way of handling it. The speaker had always held the view that the forceps represented a most valuable weapon in the armament of the orthodontist, but he agreed with Mr. Bennett in thinking that the number of cases that could be treated only by extraction was very small, and that a great number did need some supplementary treatment, which would often be much simplified if extraction were carried out. With many people the second-best or even the third-best might be better than no treatment at all. One class of patient who had to be considered was those who were prepared to make some sacrifice

for immediate dental treatment, but were not able to pay the fees for work which might be spread over months or years. One could in their case adopt what might be called *ad hoc* Orthodontics, i.e. doing a specific piece of work when the need arose and leaving anything further until some actual need for treatment again occurred. One often saw cases where the lower incisors were erupting into a space too small; treatment for a few weeks would remedy that, and the treatment might then be completed for the time being, though later on something else might have to be done. In a large number of hospital cases crowding was due to premature loss of deciduous teeth; he wished to emphasise that by care of the deciduous teeth much crowding was preventable. It was a very difficult thing when a child came along with marked crowding in the front of the mouth and a loss of space in the premolar region, so that one was faced with a double irregularity. With regard to the extraction of canines, he had seen a number of cases in which this appeared to be the best treatment, and he had not hesitated to do it, nor to tell students not to hesitate to do it if after considering all the factors this appeared to be the best treatment.

The PRESIDENT thought that Mr. Bennett had summed up the situation in his opening remarks. There were cases at one extreme which must be treated with appliances, and at the other extreme cases which could be treated quite well by extraction and without any appliances, and there were cases in the centre which needed both. One frequently saw cases in which extraction had been performed to relieve crowding, but the crowding had not been relieved at all in the finished result. This happened very often, and he had, not without misgiving, put in an appliance to retain the teeth in their positions after he had extracted others. He had wondered whether he was doing the right treatment for these children. He exhibited models of a case which came under the author's Class I, where he had removed two premolars and one lower incisor. Immediately behind the right lower central, which was removed, was the lateral, and there was more than enough space for that lateral to go into. The patient disappeared for twelve months, and when she returned the lateral was not up in position, and the space had closed so much that it was not now large enough for the lateral. Therefore, even in attempting to treat some of these cases by extraction, the orthodontist was not entirely out of his difficulties. A great deal of caution had to be exercised, and it might be necessary to put in appliances after all, where they were inclined to think at first that these were not necessary.

Mr. STEADMAN, replying on the discussion, thanked the members for the kind way in which they had received his paper. The very general agreement with which the paper had been discussed made it unnecessary for him to reply in any great detail. He realised thoroughly that mere extraction was not always the best course, and that many cases could be aided tremendously by appliances in addition. With regard to Mr. Bull's remark that the treatment of overlap was expensive, he (Mr. Steadman) by his use of that term had not meant so much expensive in money as expensive in the time taken for the actual treatment, which involved many journeys to the patient. With regard to the extraction of canines it so happened that during the past year he had not had a single case where this had been done, and therefore the method was not illustrated among the examples which he had shown, but he practised the extraction of canines, of course, on occasion.

On the motion of the PRESIDENT, who remarked on the record attendance of members and visitors to hear this paper, a cordial vote of thanks was passed to Mr. Steadman.

The PRESIDENT read his Valedictory Address.

Mr. J. LEWIN PAYNE proposed a very hearty vote of thanks to the President and to the officers of the Society for their services during the past year. To Mr. Chapman the Society owed a very great debt.

His honorary secretaryship extended during at least three-fourths of the period covered by the history of the Society, and he had represented the Society in France and the United States, and now he had added to his other services a year of distinction in the chair. He also complimented the other officers, and especially the Hon. Secretary (Mr. Packham) on the way in which he had undertaken the difficult task of succeeding Mr. Chapman in that office.

The vote of thanks was accorded by acclamation and was acknowledged by the HON. SECRETARY.

The retiring PRESIDENT announced with great regret that Mr. G. F. Cale Matthews, the incoming President, was prevented by illness from attending that meeting, and therefore it was not possible to induct him as he had hoped to have the privilege of doing.

This concluded the business.

British Society for Study of Orthodontics.

List of Members.

5th October, 1926.

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 Possener, Miss M., 143, Fordwych Road, N.W.2.
 Pritchard, Geo. B., 18, Portland Place, W.1.

Revill, W. E., 202, High Street, East Ham, E.6.
 Riddett, Stanley A., 4, Bentinck Street, W.1.
 Rilot, B. A., 22, Wimpole Street, W.1.
 Rilot, Chas. F., 22, Wimpole Street, W.1.
 Robb, George C., 22, Hoghton Street, Southport, Lancs.
 Roberts, C. W., 60, Harley Street, W.1.
 Roe, Samuel H., 60, Newhall Street, Birmingham.
 Rowlett, A. E., 165, London Road, Leicester.
 Rubra, C. H., 66, Crouch Hall Road, N.W.8.
 Rushton, W., 32, Harley Street, W.1.

Salt, H. O., 24, St. Thomas's Street, London Bridge, S.E.1.
 Samuel, Bertram B., 76, Wimpole Street, W.1.
 Sargent, V. F., 7, Harley Street, W.1.
 Schelling, C., 37, Cavendish Square, W.1.
 Scott, P., 24, Park Crescent, Portland Place, W.1.
 Sharp, P. Buckley, 76, Grosvenor Street, W.1.
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 Sturdy, Thos., 42, Claremont Road, Surbiton.
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 Sturridge, Ernest, 29a, Wimpole Street, W.1.
 Sutherland, Janet H. M., 14, Weymouth Street, W.1.

Taylor, Miriam M., 6, Cavendish Place, W.1.
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Keith, Prof. Sir A., Royal College of Surgeons, W.C.1.

